VOL. 79. PART 1 JULY, 1954

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

Banana Plantation in Southern Queensland.

COMMONWEALTH INST. OF BIOLOGY LIBRARY
- 8 SEP 1954
SERIAL Aus. 12
SEPARATE

LEADING FEATURES

Preparing Land for Irrigation
Pasture Farming
Cheese Making
Tuberculosis in Beef Cattle
Quick-Frozen Fruit
The Quince
Zinc in Soils
Bacteria in Milk
Sheep Flock Improvement
Drying Vegetables

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

EXTENSION SERVICES IN NORTH QUEENSLAND.

Atherton:	Agriculture, Soil Conservation, Veterinary Services, Cattle Husbandry, Pig Raising, Poultry Raising, Stock Inspection.
Ayr:	Agriculture, Horticulture, Plant Pest Control, Stock Inspection.
Bowen:	Horticulture, Stock Inspection.
Cairns:	Horticulture, Plant Disease Control, Stock Inspection.
Charters Towers:	Stock Inspection.
Clare:	Agriculture.
Cloncurry:	Veterinary Services, Stock Inspection.
Hughenden:	Sheep and Wool, Stock Inspection.
Ingham:	Stock Inspection.
Innisfail:	Horticulture, Dairying, Stock Inspection.
Julia Creek:	Sheep and Wool.
Mackay:	Agriculture, Dairying, Stock Inspection.
Malanda:	Dairying.
Mareeba:	Agriculture, Stock Inspection.
Mount Isa:	Stock Inspection.
Normanton:	Stock Inspection.
South Johnstone:	Agriculture, Cattle Husbandry.
Townsville:	Horticulture, Cattle Husbandry, Veterinary Services, Stock Inspection, Poultry Raising.

EXTENSION SERVICES IN CENTRAL QUEENSLAND.

Alpha:	Stock Inspection.
Barcaldine:	Veterinary Services, Sheep and Wool.
Biloela:	Agriculture, Dairying, Pig Raising, Stock Inspection.
Blackall:	Sheep and Wool.
Clermont:	Cattle Husbandry, Stock Inspection.
Emerald:	Agriculture, Sheep and Wool, Stock Inspection.
Gladstone:	Dairying, Stock Inspection.
Longreach:	Sheep and Wool, Stock Inspection.
Rockhampton:	Agriculture, Horticulture, Plant Pest Control, Dairying, Veterinary Services, Cattle Husbandry, Stock Inspection, Poultry Raising.
Winton:	Sheep and Wool, Stock Inspection.
Wowan:	Dairying.

(A list of extension services in southern Queensland will appear in our next issue.)

SUBSCRIPTION RATES.

The "Queensland Agricultural Journal" is available to Queensland primary producers whose main source of income is the land, to schools and to students for one shilling a year (12 issues). The charge to others is ten shillings a year.

Queensland AGRICULTURAL JOURNAL

Contents

Page

Field Crops—

Irrigation Practice in Queensland. Part 4. Preparing Land for Border and Furrow Irrigation. By A. Nagle 1

Fruit Growing—

The Cherry. By W. C. Armstrong 15

The Quince. By W. C. Armstrong 16

Pastures—

Pasture Farming at Biloela Regional Experiment Station. By J. H. Teakle 17

Agricultural Chemistry—

Zinc in Plants and Soils. By T. J. Beckmann 24

Beekeeping—

The Honey Flora of South-eastern Queensland. By S. T. Blake and C. Roff 26

Pig Raising—

Brucellosis-Tested Swine Herds 34

Dairying—

The Manufacture of Cheddar Cheese in Queensland. By E. B. Rice and T. A. Morris 35

Thermoduric Bacteria in Milk. By W. F. Schubert 43

Cattle Husbandry—

Bucket and Nipple Feeding of Calves. By N. Hoyer and R. M. Larkin .. 46

Animal Health—

Tuberculosis in Beef Cattle in Queensland. By D. N. Sutherland 51

Sheep and Wool—

Still More Wool! Part 6. Incorporating Fleece Measurement in Flock Improvement Programmes. By G. R. Moule and R. E. Chapman .. 55

Farm Home—

Quick-Frozen Fruit and Vegetables. By R. E. Leverington 60

Tuberculosis-Free Cattle Herds.

TESTED HERDS (As at 15th June, 1954).

The Tuberculosis-Free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements.

The studs listed here have fulfilled the conditions to the date shown above.

Full particulars of the scheme and Agreement for Testing forms may be obtained from the Under Secretary, Department of Agriculture and Stock, Brisbane, or from Divisional Veterinary Officers throughout the State.

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," M.S. 195, Pittsworth
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs. K. Henry, Greenmount
	D. R. Green, Deloraine Stud, Durong, Proston
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	C. A. Edwards, "Grasmere" Jersey Stud, Woodford
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
Polled Hereford	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu

Irrigation Practice in Queensland.

Part 4.—Preparing Land for Border and Furrow Irrigation.

By A. NAGLE, Irrigationist, Agriculture Branch.

PREPARATION OF LAND FOR BORDER IRRIGATION.

The preparation of land for border irrigation is important because hastily or badly prepared land is difficult to irrigate and leads to wasteful and ineffective use of water.

Grading.

Grading of the land is therefore required to give a uniform surface free from minor rises or depressions, so that a good even spread of water will move down the bay. It also ensures that excess irrigation and more particularly storm rain water will be drained out slowly and so prevent damage to the growing crops.

Plate 1.

A Recently Graded Field, Showing Change of Direction of Borders.

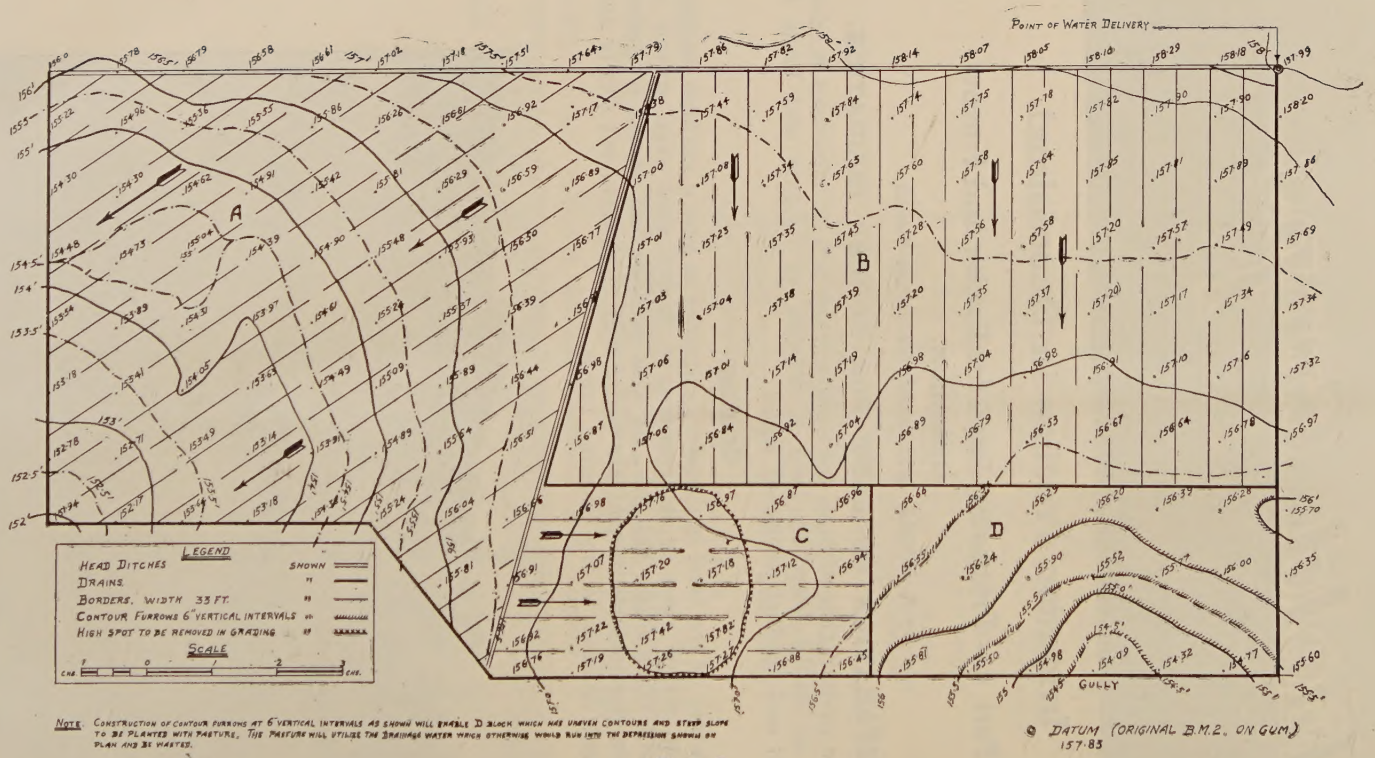

POINT OF WATER DELIVERY
A
B
C
D
LEGEND
HEAD DITCHES SHOWN
DRAINS "
BORDERS, WIDTH 33 FT. "
CONTOUR FURROWS 6" VERTICAL INTERVALS
HIGH SPOT TO BE REMOVED IN GRADING
SCALE
GULLY
DATUM (ORIGINAL B.M.2. ON GUM) 157·83
NOTE. CONSTRUCTION OF CONTOUR FURROWS AT 6" VERTICAL INTERVALS AS SHOWN WILL ENABLE D BLOCK WHICH HAS UNEVEN CONTOURS AND STEEP SLOPE TO BE PLANTED WITH PASTURE. THE PASTURE WILL UTILISE THE DRAINAGE WATER WHICH OTHERWISE WOULD RUN INTO THE DEPRESSION SHOWN ON PLAN AND BE WASTED.

Plate 2.

Contour Plan and Design of Border Irrigation and Pastures. Construction of contour furrows at 6 in. vertical intervals as shown will enable D block, which has uneven contours and steep slope, to be planted with pasture to utilise the drainage water which would otherwise run into the depression shown on the plan and be wasted.

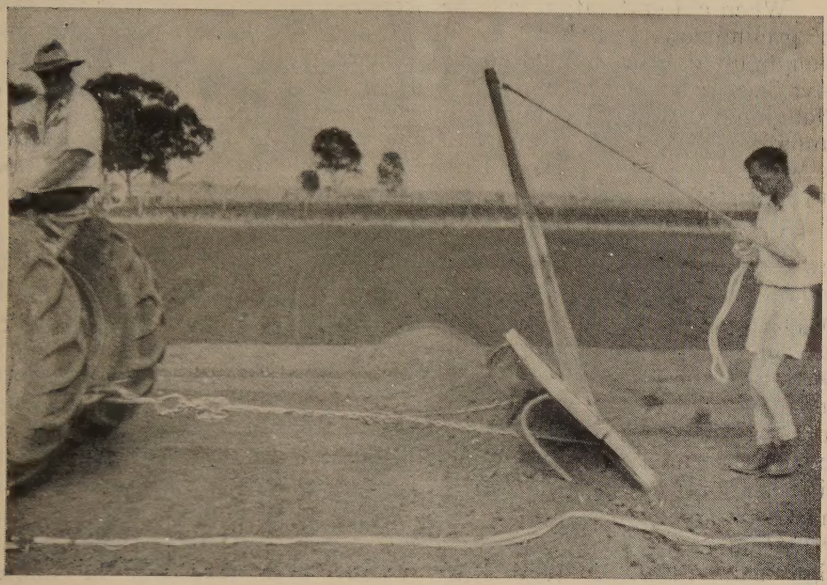


Plate 3.

Scraper Board Dropping Soil on the Site of a Check Bank.

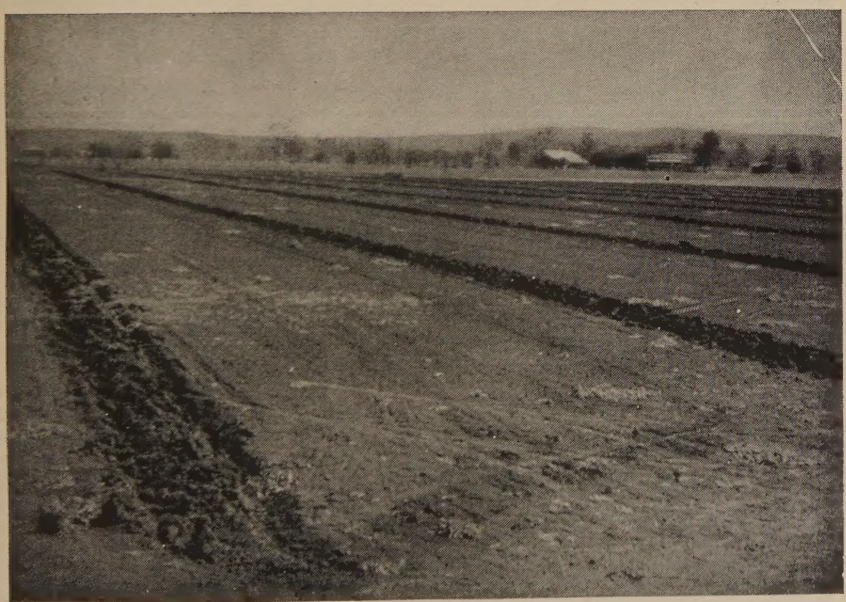


Plate 4.

Positions for Check Banks Marked Out with Plough Furrows. In cross grading, soil is deposited on these furrows to form check banks.

When old cultivation is to be prepared for irrigation it is advisable in preliminary ploughing to fill in dead or finishing furrows and plough up crowns formed in the ploughing, particularly when lands have been commenced and finished on the same sites for some time. Ploughing should be done before and during grading operations, in lands in the direction of the slope or grade of the field. The soil should be worked to a good tilth and should be in a dry condition for efficient grading; wet cloddy soil does not flow easily from the grader blade.

Where much soil has to be "cut" or removed from high spots, or low areas are to be filled, a scoop is a valuable implement, especially where soil has to be transported a considerable distance. After the major irregularities, if any, are removed the grading should be down the slope, after which operation grading across the slope is required. During this latter operation the material for the check bank is collected and deposited on the sites previously marked out with shallow plough furrows (Plates 3 and 4). Where side or cross fall occurs between the check banks the soil for the banks should be brought from the high side of the bay and deposited on the check bank site. The maximum side or cross fall allowed is one inch per bay; otherwise the irrigation water would flow down the low side of the border, with the high side receiving very little water, thus resulting in uneven distribution.

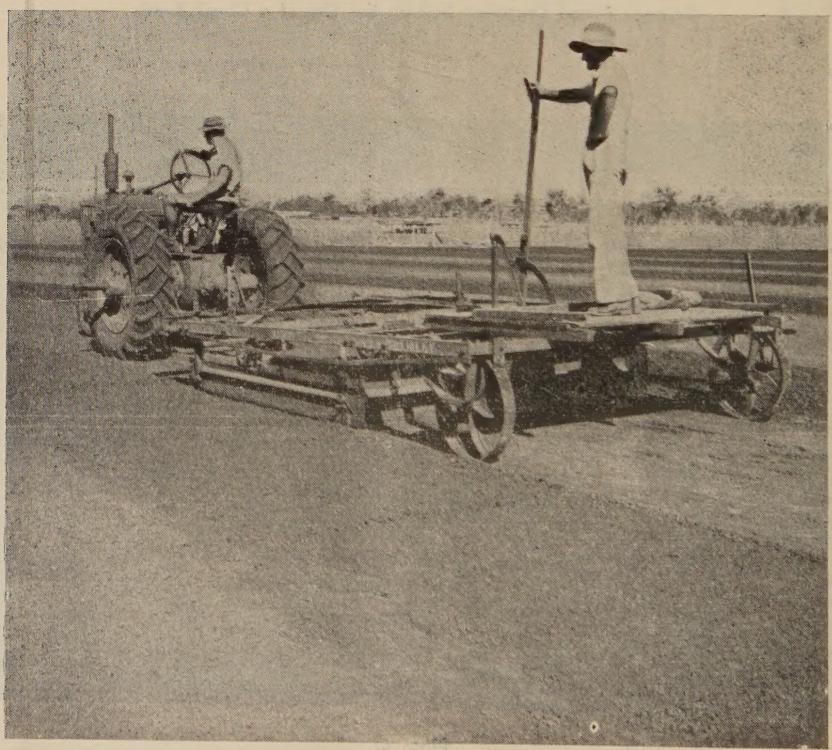


Plate 5.

Final or Corrective Grading Being Made in Borders Prior to Planting Lucerne.

Plate 6.

Border Irrigated Pastures. The borders are 5 chains long and 26 feet wide. On soils with a high soakage rate, short borders allow the water to be applied quickly enough to avoid over-watering. The tail drain for removing excess irrigation or storm water is at right angles to the borders and can be seen in the middle of the picture.

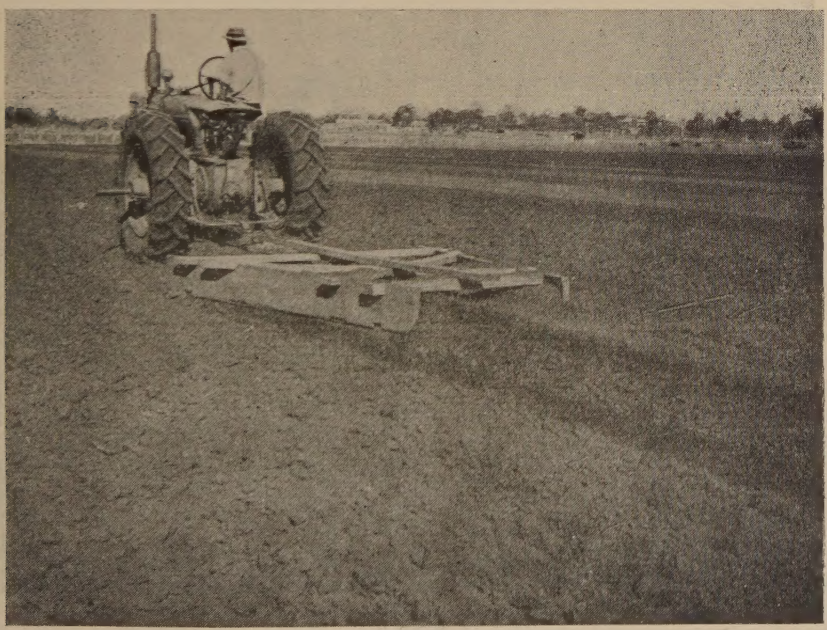


Plate 7.

Crowder Giving Final Shaping or "Crowding" of Check Banks on Land Being Developed for Border Irrigation.

Where side fall is excessive, it is advisable to have narrower bays to save much cross grading, though the width of the bay is governed also by such factors as soil type, slope and quantity of water available. The maximum width of bay is 33 feet. This width is used on fairly heavy, relatively impermeable soils on moderate slopes where a good supply of water is available. On sandy loam soils or where water supply is limited, a spacing of 16-20 ft. would minimise water usage, as a bigger flow per unit area could be used. Where water is to be conveyed in portable pipe lines, the bay width can conveniently conform to the length of pipe in use.

Bay length is determined by the same factors as govern bay width, namely, soil type, slope and water supply. The usual length is from 5 chains on loamy soils to 8 chains on heavier soil types.

The mounds of earth deposited on the check bank sites need compacting and shaping and this can be done effectively with a crowder (Plate 7). This implement is drawn along the check bank line and crowds the soil into a compact evenly-shaped bank.

A suitable size for check banks is 2 ft. 6 in. wide by 6 in. high when consolidated, a low flat bank being desirable rather than a narrow high bank, as the former allows free passage of mowers and other implements when the crop or pastures need mowing or other treatment (Plate 8). Very large banks are unnecessary. If they are used, an appreciable area of the field is devoted to banks. Large banks may be only partially productive due to inefficient lateral penetration of irrigation water.

Plate 8.

Mowing of Lucerne Being Done Across the Check Banks. Wide, low check banks are desirable so that mowers and other implements can move freely over the check banks.

On heavy soils which crack freely on drying, it is necessary to build check banks somewhat larger to prevent seepage of water from one bay to another during irrigation.

Where heavy grading and filling of low spots has been necessary, it is advisable to plant an annual crop following grading to allow for settling of "filled" areas before a planting of a permanent nature is attempted. It is not advisable to construct permanent check banks when annual crops are to be planted. Following harvesting, grazing or mowing of the annual crop, the residue or stubble usually has to be removed.

Prolific weed growth during summer fallow is likely and this has to be destroyed by either discing or light ploughing. Whether annual cropping or lengthy fallowing is adopted, breaking down of check banks in removal of crop residues or weeds is usual, this being followed by reforming or crowding the banks.

Where plantings of permanent crops cannot be made for some considerable time after grading is completed, it is suggested that temporary check banks be thrown up with a disc plough. set at a shallow depth. These temporary check banks can be ploughed during weed control operations and permanent check banks constructed and a final light grading or smoothing given just prior to planting of permanent crops.

In forming temporary check banks with a plough, a shallow furrow or depression is left on both sides of the bank. This depression must be filled in, otherwise the irrigation water will flow down the depressions, resulting in inefficient watering. On relatively steep slopes a continued flow can cause soil erosion, with a reduction in size and weakening of the check banks.

Head Ditch.

Construction of a head ditch from the pump delivery to the area to be irrigated is required, the size of the ditch varying according to the quantity of water to be carried.

As the water is distributed from the head ditch, it is necessary that the water level in the ditch be at least 4 in. above the natural surface of the ground to be irrigated. This requires that the banks of the ditch be 9-10 in. high to give the required height or depth of water in the ditch and so permit a free discharge of water into the bays or furrows.

Shallow ditches wide enough to give the required amount of "spoil" to form adequate banks are recommended. Where narrow deep ditches are used, a considerable amount of "dead" or unused water remains in the ditch after irrigation is completed, causing heavy weed and grass growth, which in turn restricts flow of water. Furthermore, narrow deep ditches are difficult to maintain free of weeds by mechanical methods, whereas implements such as a small rotary hoe or motor mower with a cutting width of 3 feet can be used successfully in wide ditches.

Ditches can be constructed by various methods. With some experience a ditch can be built with a 2-furrow disc plough, a minimum of hand work being required. The usual method of constructing ditches is with a "delver" made either of steel or wood, the wooden delver being easily constructed.

Plate 9.

Distribution of Water in Borders from 1¼-in Sockets Soldered into 4-in. Portable Main Line Pipes.

Plate 10.

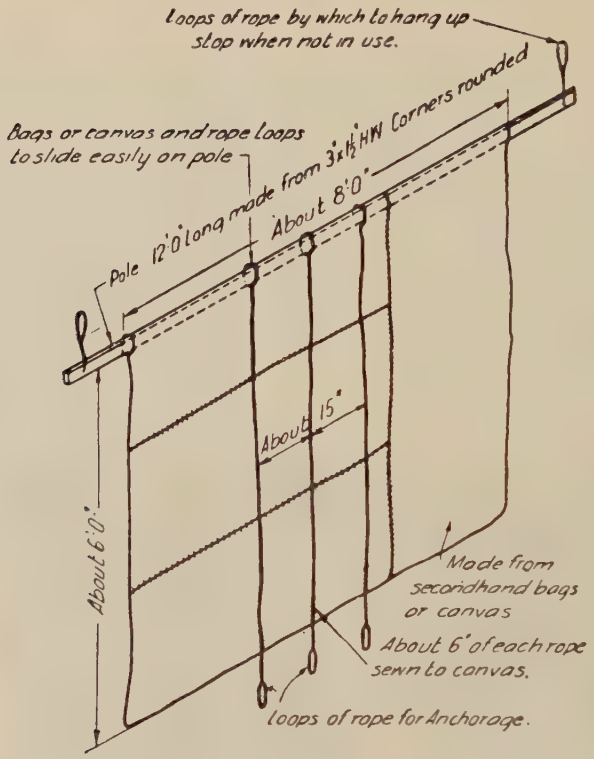
Border Irrigation of Newly Sown Pastures, Using Pipe Distribution from 1¼-in. Sockets Soldered into 4-in. Mains.

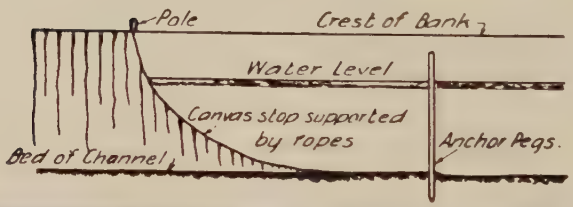
An alternative method of water distribution is the use of pipes, either portable or permanent installations (Plates 9 and 10). Where losses of water by seepage in head ditches are likely to be high, the use of pipes would overcome this, though the friction head is increased considerably when pipes of small diameter are used. Distribution into borders or furrows can be accomplished by using T pieces or bends for portable pipe-lines, or 1½ in. sockets can be soldered into the pipes, four to each length. Plugs are inserted in one or more sockets to vary or stop flow as required.

The size of the ditch is dependent on (*a*) the amount of water to be carried and (*b*) the slope of the land. A steeper grade needs a smaller ditch than a flat grade. However, the ditch should be constructed with as flat a grade as is practicable. Ditches on steep slopes are liable to erosion, and, in addition, check structures are needed to raise the water level in the ditch adjacent to the area being

Plate 11.

Head Ditches with Wooden Check Structures. Note the raised level of water behind the checks.


Loops of rope by which to hang up stop when not in use.
Bags or canvas and rope loops to slide easily on pole
Pole 12'0" long made from 3"x1½" H.W. Corners rounded
About 8'0"
About 15"
About 6'0"
Made from secondhand bags or canvas
About 6" of each rope sewn to canvas.
Loops of rope for Anchorage.



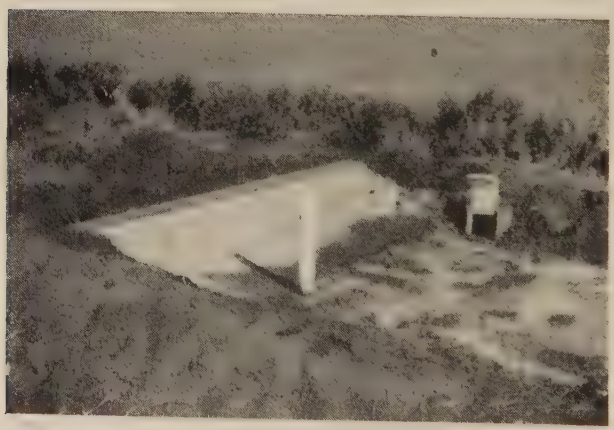


Plate 12.

Sketch and Photograph of Portable Canvas or Bag Check, Showing Construction and Position in Head Ditch. The sketch is taken from a publication of the Victorian State Rivers and Water Supply Commission.

watered. Permanent wooden (Plate 11) or concrete checks are used, boards fitted in cleats on the sides of the checks raising or lowering the height of water as required. Portable checks of sheet metal are also used and are forced in the sides of the head ditch to raise the water height. A most useful check is the portable canvas check, which as the name implies is a sheet of canvas (or bag) nailed to a piece of wood (Plate 12). The canvas is pegged down in the bottom of the ditch and forms an effective check; being light, the bag or canvas check can be easily transported wherever required.

A ditch 24 in. top width x 6 in. deep x 10 in. bottom width would carry approximately 22,000 gallons per hour on a grade of 3 inches per 100 feet.

Plate 13.

Precast Concrete Water Outlet in Head Ditch. This outlet has a sheet-iron regulating slide.

Grass growth is difficult to control in ditches and slows and obstructs flow of water, so for practical purposes head ditches should be built to give at least 50% more water than usually required. It is recommended that head ditches be constructed with 4 ft. top width and 2 ft. 6 in. bottom width to allow for possible obstruction by weeds and grasses.

Gates or boxes should be installed in the head ditch to regulate the flow of water into individual bays. These are of various designs, a type common to most irrigation areas being a wooden or concrete structure having an opening 12-15 in. wide by 8-10 in. deep, so constructed that either wood or metal gates regulate or close off the water supply as needed (Plate 13). Syphon tubes of either metal or plastic are also used to deliver water from the head ditch. However, fairly constant patrolling is necessary to ensure that the flow is not broken.

Another form of outlet used in Queensland is constructed by screwing together 4 pieces of 6 in. x 1 in. hardwood to form a box or tube, the usual length being 4 ft. 6 in.; a slide working in saw cuts in one end of the box acts as a regulator for flow of water (Plates 14 and 15).

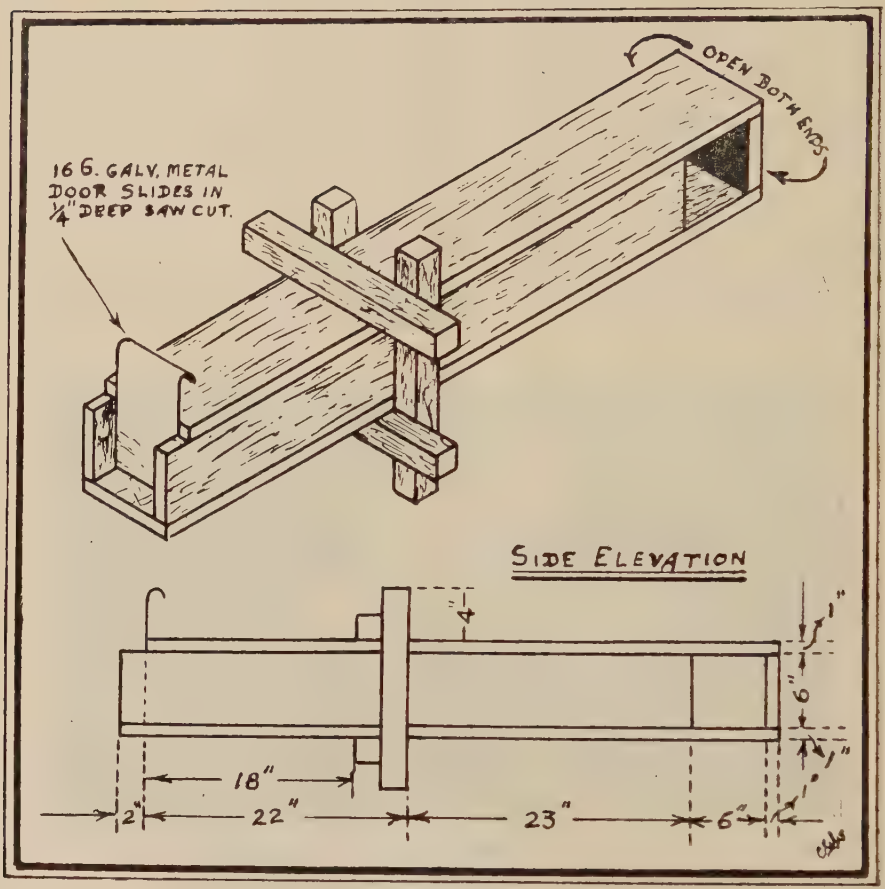


Plate 14.

Sketch of Wooden Outlet Box, Showing Method of Construction.

Plate 15.

Wooden Water Control Box or Outlet in Head Ditch. This outlet needs placing lower to give a full flow of water from the head ditch.

Outlets of either type should be placed so that a full flow or head of water is obtained from the ditch. A good guide in installing outlets is to fill the head ditch with water, the height of water or "foam line" being marked with small pegs and the outlets being placed just below this line.

Construction of Tail Drains.

Drainage of surplus irrigation and more particularly storm water runoff from irrigated areas is very important and essential; otherwise waterlogging of the soil with damage to both soil and crops would result.

To ensure efficient drainage, a wide shallow drain is constructed at the lower end of the bays and this drain is connected with a drainage channel or to a natural outfall or low area. Effective use can be made of drainage water by planting water-tolerant pasture species in the disposal area.

At the Bureau of Investigation's Irrigation Station at Gatton, all drainage water is diverted to a low area near the main entrance gate. Para grass and strawberry clover have been planted in this area. The land has been graded and check bank and permanent check structures installed so that drainage water can be controlled and diverted into bays as required or into a drainage channel outside the area in times of excessive rainfall.

PREPARATION OF LAND FOR FURROW IRRIGATION.

The procedure for preparation of land for furrow irrigation is similar to that required for development of border irrigation. However, as the water is distributed throughout the field in furrows, erection of check banks is not required.

Plate 16.

Furrow Irrigation of Cotton. Note the even flow or advance of water down the furrows on well-graded land.

Head ditches, tail drains and outlets for control of water from the head ditches are all required. Water is distributed directly into each irrigation furrow by small outlets or pipes in the head ditch. This method gives good control of water application, but installation is expensive where annual crops are irrigated. The more usual method is to use large outlets spaced 20-30 ft. apart, which deliver water to a small ditch or "turn row" formed at the top of and connected to a group of 8-12 furrows (Plate 17). Variation in furrow flow is possible by varying the size of furrow opening, usually grass or bags being used to give a fairly constant opening, and in consequence a fairly even flow can be given to each furrow.

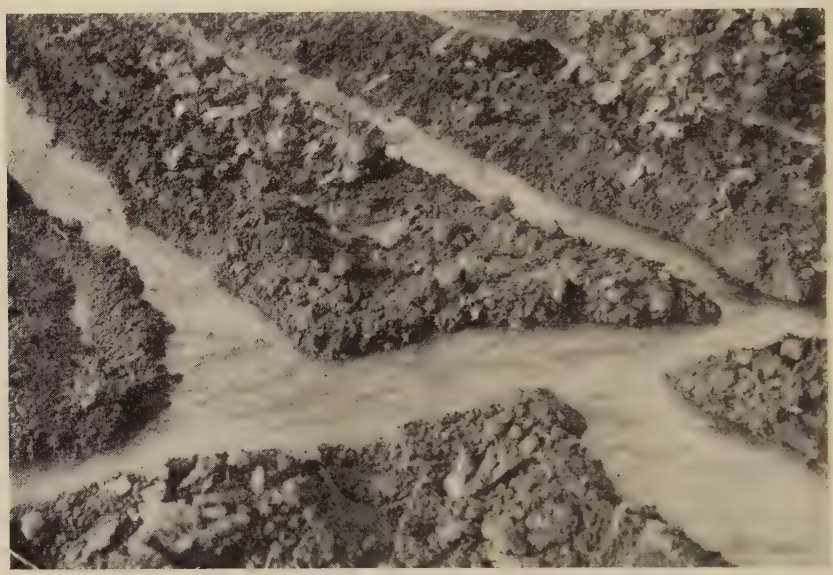


Plate 17.

Furrow Irrigation of Cotton, Showing Water Being Distributed in Furrows from a Small Secondary Furrow or "Turn Row."

As the furrow method is used mainly for irrigation of row crops, the irrigation furrow spacing is usually decided by width of row for the particular crop grown. However, the soil type has an influence on furrow spacing, sandy soils with free vertical and poor lateral penetration requiring closer spacing than for heavier soils in order to give uniform wetting of the area being irrigated.

A SPECIAL RADIO SERVICE FOR FARMERS

★ ★ ★

The COUNTRY HOUR, a special service for farmers, is broadcast DAILY through the National and Regional Stations from 12 to 1.

The Cherry.

By W. C. ARMSTRONG, Adviser in Horticulture.

The cultivated cherry is divided into two groups—the dessert sweet cherry (*Prunus avium*, fam. *Rosaceae*), a vigorous, upright-growing tree, and the sour cherry (*P. cerasus*), a smaller, irregular-growing species, the fruit of which is used mainly for jams and preserves.

Although the cherry thrives on many types of soil, it will not tolerate poor drainage.

Cherries are generally propagated on Mazzard and Mahaleb stocks. On the more fertile loams with adequate supplies of soil moisture, Mazzard is the preferred stock; trees on Mahaleb stock are rather smaller than those on Mazzard stock, and do better on light sandy soils where stress conditions sometimes occur. When vigorous growing scion varieties are worked onto Mahaleb stocks, the union is often overgrown. Both stocks are budded in summer when the bark lifts freely, the bud being cut with rather more "wood" than in most other stone fruits.

Cherries are self-sterile and two or more varieties are interplanted in the orchard to ensure cross-pollination; at least one pollinator is required for each nine trees of the main commercial variety planted.

The cherry is grown only on a small scale in Queensland but some of the more popular varieties are:—

Sweet Cherry—

Early.—Early Rivers, Burgdorf's Seedling, Knight's Early Black.

Mid-season.—Black Tartarian, Bedford's Prolific, Black Republican.

Late.—St. Margaret, Napoleon, Bigarreau (a splendid dessert variety which is also very good for preserving), Florence.

Sour Cherry.—Morello, Kentish Red and Montmorency are suitable for cooking and jam making.

After planting, the young trees should be pruned in the same way as other types of stone fruit for the first three of four years to form a well balanced tree of good shape. From then on, only light thinning is required. The leaders are left unpruned and, as the fruit-bearing spurs are long-lived, less renewal wood is retained than in other deciduous trees. Interlocking branches or dead wood should be removed.

The Quince.

By W. C. ARMSTRONG, Adviser in Horticulture.

The quince (*Cydonia oblonga*, fam. *Rosaceae*) is a bushy, irregular type of tree, about 12 feet high, the fruit of which is valued for use in preserves and jellies. It grows under a fairly wide range of climatic conditions, but is particularly suited to cool temperate areas.

In Queensland, production is restricted mainly to the Granite Belt, but plantings are generally limited to the headlands of established apple, pear or stone fruit orchards. In a deep fertile loam, the tree is both hardy and vigorous.

The quince can be propagated by layering, by cuttings, or, more extensively, by stooling, and the tree is invariably grafted on quince stock.

The more popular varieties are:—

Orange Quince.—Tree generally of slender growth with oval leaves. Fruit large, roundish and somewhat irregular, with a small, very short neck; bright golden colour; firm flesh with excellent flavour.

Portugal.—A vigorous tree with broad leaves which are cordate and downy. Fruit large, pear-shaped, and tapering at each end; flesh firm. Matures a little later than Orange Quince.

Rea's Mammoth.—A very vigorous tree with large, dark-green foliage. Fruit resembles the Orange Quince but is much larger.

TRAINING.

The quince is naturally a shrubby tree and if left unpruned it develops a mass of suckers which overgrow the parent. To renovate trees which have reached this stage, all but one selected stem can be removed, or, alternatively, three or four well spaced stems may be retained, both limbs and water shoots being cut away to allow light into the centre of the tree.

Nursery trees grow rapidly after they are planted in the orchard and respond to the pruning methods used during the dormant period for shaping young apple and pear trees. The young trees should be headed back low to produce a short trunk. When the top two or three shoots are well developed, the surplus shoots on the stem can be removed. The following year the leaders can be pruned hard so that each will produce two more leaders. The same procedure is followed in the next year. The tree will then have a good framework of 8-12 leaders. During the summer months, any unwanted shoots are removed.

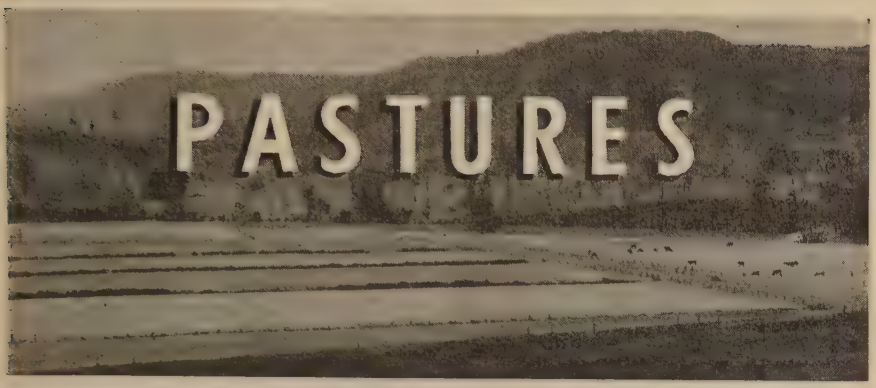
PRUNING THE BEARING TREE.

After the framework has been established, hard pruning is no longer necessary. The leaders should, however, be lightly headed back each year and lateral growth may be tipped or, where necessary, removed entirely.

The fruit is borne singly at the terminal of a short, leafy shoot produced in the spring. Each fruit-bearing shoot develops from a terminal bud on a spur which, as in the apple, may be branched. Spurs which bear fruiting shoots are at least two years of age. Spur growth may be tipped in pruning and much of it is removed when lateral shoots and branches are thinned out. Flower buds also occur on 1-year-old terminal shoots.

CULTURAL TREATMENT.

Soil management, including cultivation, green manuring and fertilizing, are much the same as in apple orchards.



Pasture Farming at Biloela Regional Experiment Station.

By J. H. TEAKLE, Regional Experiment Stations Staff.

During the past ten years consideration has been given in Queensland to growing promising grasses and legumes in cultivated rows. In practically all instances greater production of forage with higher protein content has been obtained, the growth period has been prolonged and spring regrowth has often been possible even when early rains were not experienced.

Trials at the Biloela Regional Experiment Station with Rhodes grass, blue panic and green panic, and at the C.S.I.R.O. Station at Lawes with scrobic, other grasses and lucerne, gave evidence of better moisture penetration in areas with plants grown in cultivated rows. In some instances the addition of lucerne, either in the row of grass or in alternating pure rows, appears to have stimulated grass growth and the mixture contributed more protein. However, competition for moisture sometimes resulted in grass decline in dry periods when the lucerne could collect water more efficiently.

In studying the factors associated with the increased production from row cultivated pasture, moisture factors were initially considered of most importance. The "border effect" achieved in rows was considered to be due to better moisture and to greater exposure to sunlight permitting better synthesis of plant nutrients. Further investigations suggested that the nitrate nitrogen status of the soil and its improvement under conditions of periodic cultivation were of far greater importance. This fact has been evident in all recent studies, for although moisture may be adequate, the successful growth is still more closely correlated with the available nitrogen in the soil.

The experiment reported here was conducted during the 1950-53 period and compared the yield and development of green panic grass grown in swards with the same grass grown in cultivated rows with lucerne initially occupying every third row.

In this experiment green panic (*Panicum maximum* var. *trichoglume*) was studied as an alternative to Rhodes grass, which is already well established as a pasture species in the Callide Valley. Green panic has shown considerable promise in Central Queensland. On the Callide Valley alluvial soils, it makes vigorous growth during the first year of establishment in swards (see Plate 1) and frequently exhausts the available nitrogen at a rate exceeding normal production. This condition is less marked on some soil types of the district, such as those on which a mixture of brigalow and softwood

Plate 1.
Green Panic Sward at Biloela Regional Experiment Station.

Plate 2.
Grazed Green Panic and Blue Panic.

scrub occurs, where the available nitrogen status is considerably higher. Green panic has been found to be highly palatable to stock and has a nutritive value comparable to the best Rhodes grass. Its palatability to stock is indicated in Plate 2, which shows this species heavily grazed while blue panic remains untouched.

DESIGN OF EXPERIMENT.

Two adjacent areas on the Biloela Regional Experiment Station have been compared, both of Callide alluvial soil type. One area was planted to green panic alone in a sward and the other was planted in rows 42 in. apart with two rows of green panic to each row of lucerne. In previous work the sward plantings of pure green panic grass showed marked decline after the first season, so in this experiment the production from the common sward-sown pasture was compared with the yield of a row cultivated pasture of green panic with lucerne added. The inter-rows were cultivated as necessary to keep down weeds and grass seedlings. The grasses were sown in February 1950 and the lucerne was incorporated in the row treatment in March 1950.

The yield of forage of both grass and lucerne was obtained by cutting and weighing the material from a number of sample sites of known area. These sites were each of 25 square feet, being either a 5 ft. x 5 ft. square in the sward area, or 7 ft. 2 in. length of row (42 in. row spacing). The number of sites sampled ranged from 3 to 5, depending on the evenness of the crop. From these weights the average yield per acre was calculated after being adjusted in proportion to the actual area occupied by each species. Grazing of the areas was continued throughout the period of the trial, except for one mowing in January 1953, when sufficient animals were not available.

GROWTH OF PASTURES.

1950.

In the first short wet summer period of 1950, the green panic sward gave a great bulk of growth, producing 4½ tons per acre of grass hay in the first nine weeks.

A good growth of grass and lucerne in the rows was made in the first short summer period, but total hay production was only half of the amount obtained from the sward sowing. This is quite typical of first season results under Biloela conditions. The amount contributed by the lucerne in the first season was only 0.17 ton per acre.

1950-51.

In this season the sward pasture produced 2.13 tons of hay per acre, this being less than half of the first year's production, while the row pasture produced 5.81 tons per acre, of which 1.17 tons was supplied by the lucerne rows.

1951-52.

The third season experienced severe drought conditions and the production from the sward pasture was only .33 ton per acre, or 1/14th of the first season's growth. Under these seasonal conditions the cultivation of row pasture produced a yield of 2.78 tons of hay, of which 2.27 tons came from the green panic rows and .51 ton from the lucerne. These figures indicate the real benefit of moisture conservation together with adequate nitrate-nitrogen production.

1952-53.

This was a typical good season for the Callide district, with a wet summer, but only .49 ton per acre of hay was obtained from the green panic sward pasture. The green panic and the lucerne rows produced 2.51 tons of hay per acre, of which .78 ton came from the lucerne.

DISCUSSION OF RESULTS.

During the four seasons the yield of pasture on a dry weight basis totalled 7.45 tons per acre from the sward planting and 13.33 tons per acre from the green panic and lucerne rows. The seasonal production is shown in Table 1, which also indicates

TABLE 1.
PRODUCTION FROM PASTURES.

Season.	Yield of Hay from Green Panic Sward.	Yield of Hay from Green Panic Rows only.	Yield of Hay from both Green Panic and Lucerne Rows.
	tons/ acre.	tons/ acre.	tons/ acre.
1950 ..	4·50	2·06	2·23
1950–51 ..	2·13	4·64	5·81
1951–52 ..	0·33	2·27	2·78
1952–53 ..	0·49	1·83	2·51
Total ..	7·45	10·80	13·33

the production of green panic alone in the rows. It will be noted that 60% of the yield from sward pasture was obtained in the first short season of nine weeks.

The accumulative yield of hay-dry forage from the sward, and from the green panic and lucerne rows, is illustrated in Fig. 1. Rainfall during the period of the experiment is also shown in this diagram.

The annual production from the cultivated rows, though poor in the first season, surpassed the yield from the sward sowing in each of the three

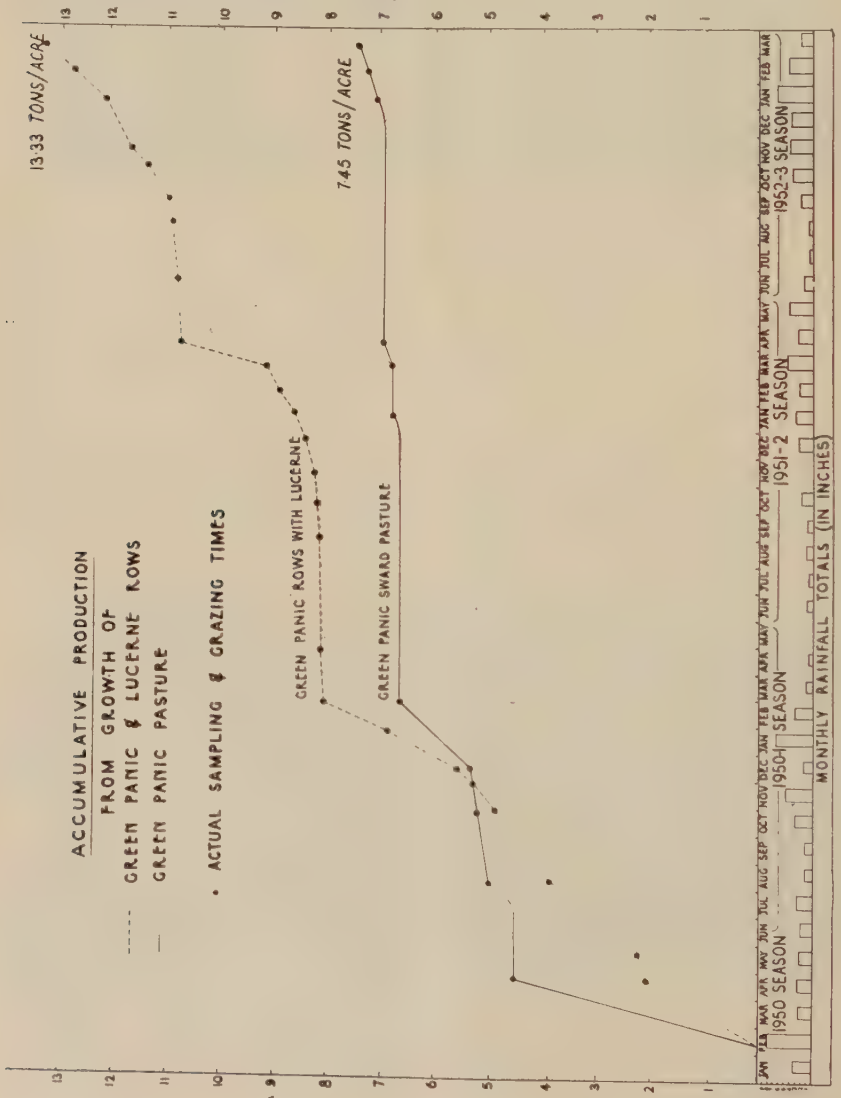


Fig. 1.—**Production from Pastures.**

following seasons. The total production over the last 2-year period was only 0.82 ton from the sward, while the rows produced 5.29 tons of hay per acre.

The decline in production under sward conditions was closely correlated with nitrogen supply, and signs of nitrate shortage were clearly evident six months after planting. This point is illustrated clearly in Plate 3. The more vigorous growth around the edges of the sward pasture area, where more moisture and more nitrogen would normally be available, is shown.

Although production in the first season from rows was less striking, the rate of production was far greater in the second year and the decline over the two following seasons was more gradual. The lucerne contributed a fairly regular supply of green grazing and continued active production up to the fourth season, although crowded to some extent by green panic seedlings. It is possible that symbiotic nitrogen production by root nodules on the lucerne contributed somewhat to the better development of the associated grass.

At the end of the first season there was no evidence of nitrogen shortage in the row area and the growth of the green panic was surprisingly even. The condition of the row pasture at the end of the first season is illustrated in Plate 4.

The rows yielded an average of almost 3½ tons of forage each year, which represented an annual gain of over 1½ tons per acre over the sward pasture. This increase in production would fully justify the required two or three cultivations throughout the season. The increase in total production is important, but as it has been shown that cultivation of rows permits a longer season of active growth, this latter aspect of the work assumes greater significance.

In normal summer seasons, pasture production over most of the State is adequate for the livestock industries. However, the autumn to early spring period is a critical time when supplementary feeding or removal of stock is frequently necessary. The row pasture provided green grazing well into the autumn season, there being sufficient stored moisture and adequate nitrate-nitrogen to permit this development. Even during the winter the lucerne in the rows produced a picking of high-protein material, which in combination with the drier grass would furnish adequate nutrients for livestock maintenance.

While residual soil moisture was present the winter production of lucerne was satisfactory, and indeed the lucerne utilised any winter rainfall recorded and limited the supply available for the associated grass in the early spring period.

Even with this competition the grass in rows showed earlier response than that under sward conditions, the former giving fair yields in early October while the growth from swards did not occur until summer rainfall from December onwards.

During the first two years a balance of growth was maintained within the row cultivated pasture, the lucerne rows gaining an advantage in the winter, spring and early summer months, while the vigorous green panic became dominant in the midsummer to autumn months until frosted. In April 1952, green panic seedlings became common in the lucerne rows and contributed to even better production of grass during the midsummer to autumn months, although at the expense of the development of lucerne during this period. By February 1953 the grass was sufficiently dense to seriously affect the lucerne production, and it was considered that a continuation of this pasture would finally result in complete domination of the lucerne. However, as this technique is recommended for a short pasture phase (4–5 years) in a cropping rotation, this factor is not of great significance.

Nutritive Value.

Observations during the four seasons indicated that the row green

Plate 3.

Green Panic Pasture Six Months After Planting. Note the poorer growth in the centre of the area than along the edges, due mainly to nitrogen shortage.

Plate 4.

Green Panic and Lucerne Rows Six Months After Planting. Showing an Even Luxuriant Growth.

panic pasture was more attractive as grazing forage, and it is well known that the lucerne would contribute to a much higher level of protein in this type of pasture. The sward pasture as production declined showed a yellow colour indicative of nitrogen shortage, except for small areas of rich growth obviously associated with animal excrement, and appeared to be of a much lower standard for grazing than the same grass under row cultivated conditions. In March of 1953, when samples were taken when the grass in both treatments had headed, the crude protein was determined as follows:—

Row cultivated green panic 7.4%
Sward grown green panic 5.8%

Cultivation of Row Grown Pasture.

Green panic does not invade the inter-row spaces as does Rhodes grass and other grasses of creeping habit. Inter-row cultivation can therefore be carried out with tined cultivator or scarifier implements, unless creeping weeds become very numerous.

A tractor mounted 2-row cultivator was used in this row pasture and proved to be efficient and manoeuverable, and ordinary drawn types of wheel tine implements such as the scarifier or combine could be used if surplus tines were removed.

The inter-row cultivation was usually necessary to a depth of 3 in. following the dormant winter period of the grass, but the subsequent spring and summer cultivations were made just deep enough to destroy weed and grass seedling growth.

Two or three cultivations each year are generally sufficient to destroy weed growth and obviate soil moisture wastage, these cultivations generally being required in spring and summer, unless vigorous winter weed species are present.

SUMMARY OF FINDINGS.

(1) On Callide Valley alluvial soils, row-grown grass with lucerne produced more feed per year than sward-grown grass, except during the first season. The total yield from the row-cropped area over the 4-year period was almost double that produced by the sward. (Cultivation between the rows assisted moisture penetration and nitrate-nitrogen production and weed growth was checked).

(2) The incorporation of lucerne provided green grazing in the winter and the high protein legume would allow better utilisation of the grass by livestock. The grass grown in association with lucerne always appeared more vigorous and did not exhibit signs of nitrogen deficiency.

(3) The production from the sward grass pasture was limited after the first season, averaging 0.98 ton of hay per acre in each of the three succeeding years, as compared with 3.70 tons of hay per acre from the rows of grass with lucerne for each of the same three years after the first season.

(4) The nutritive value of the row grass even without the lucerne was superior to that of the sward grass pasture, while the additional picking of green lucerne increased the pasture value considerably.

(5) The work to date indicates that the vigour of the row cultivated green panic with lucerne can be maintained on the Callide Valley alluvial soils for at least four years. This period is considered long enough for soil improvement before reworking of the land for crop production for another 4–6 years.

(6) The extra grazing and better nutritive values obtained with row cultivated pastures of green panic and lucerne would fully justify the two or three annual cultivations involved, and as the method produces green grazing in the seasons of normal pasture decline, greater benefits would be reflected in animal returns.

Agricultural Chemistry

Zinc in Plants and Soil.

By T. J. BECKMANN, Analyst, Plant Nutrition Section, Chemical Laboratory.

Zinc is one of the elements necessary for the healthy growth of plants. Although it is required only in small or "trace" amounts in soil, it is often lacking or is in a form which the plant cannot utilize.

Symptoms.

The symptoms now known to be associated with zinc deficiency in many plants were well known long before their cause was determined.

Zinc deficient plants have been shown generally to have a lower zinc content than healthy ones or those where zinc has been applied and have recovered. In all plants showing the disease some form of leaf yellowing is noticed. It is thought that zinc plays a part in the production of chlorophyll, the green colouring matter of plants. Where chlorophyll production is impeded, leaf production is hindered and leaves are small in size.

Other symptoms, such as malformation and reduced fruit production, are probably due to insufficient leaf production.

While no reliable method exists for assessing the exact relationship between soil zinc and the quantity in the plant, it is known that on light sandy soils where extensive leaching has occurred zinc deficiency is liable to appear.

On soils of high pH or on heavily limed soils, zinc deficiency can appear because the soil zinc may form insoluble compounds. It has been noticed that zinc availability varies with pH, being lower as the pH rises —the critical region being between pH 5.5 and 6.5. On light acid soils continued cropping will reduce the naturally available zinc, which also may be reduced by combination with organic compounds in the soil.

In passing, it may be noted that zinc and copper deficiencies frequently occur together.

In Queensland, zinc deficiency occurs along the coastal belt and on the southern highlands.

The various names given to the disease, such as little-leaf or rosetting of pome and stone fruits, mottle leaf of citrus and white-tip of maize, describe the chief symptoms of the plant concerned.

In broad-leaved trees such as fruit trees the usual symptoms are:—

(1) Yellowing between the veins often with dying of patches and pigmentation.

(2) Reduced leaf size.

(3) Sparse foliage, with the terminal internodes of the branchlet shortened (rosetting).

(4) Reduced fruit production.

In apples and pears, the leaves of deficient trees are very small and of a pale dull colour. Mottling occurs especially in summer and autumn. Stone fruits show light-green or yellowish leaves with light green-yellow patches between the veins. The leaves become crinkled and small in size.

In cereals, young plants show purpling and death of the older leaves. The straw of mature plants has a characteristic greyish appearance.

Treatment.

Addition of zinc (as zinc sulphate) to the soil is the easiest method of treating cereal or pasture crops, but the best method for overcoming the deficiency in trees is by means of a foliage spray.

For citrus trees the recommended spray is 4 lb. of zinc sulphate and 2 lb. of well slaked lime to 40 gall. of water. This should be sprayed during spring when growth is flush. If desired, a spreader may be added. Spraying is usually necessary only once in 3-5 years.

(If copper and zinc are applied together, then the spray should consist of 4 lb. of zinc sulphate, 1½ lb. of soda ash, 1½ lb. of Cuprox or similar copper compound, and 40 gall. of water.)

For deciduous fruits, a spray consisting of 50 lb. of zinc sulphate to 100 gall. of water is applied during the dormant period. It is generally necessary to treat every year.

Soil applications vary between 7 lb. and 14 lb. of zinc sulphate per acre.

ADVICE ON FERTILIZERS AND SOILS.

As part of its services to primary producers, the Department of Agriculture and Stock makes recommendations for improving and maintaining the fertility of the soil.

In most cases, the information given is based on the data accumulated from observations over many years on crop behaviour on particular soil types and on analyses made in the course of soil surveys and field trials, as well as on analyses of samples previously examined. Soil samples have now been analysed from most of the soil types in the farming districts of Queensland.

Enquiries from farmers on soil treatment should normally be submitted in the first instance to the Adviser in Agriculture or Adviser in Horticulture stationed in the district. In areas where there is no easily accessible advisory officer, a letter of enquiry should be sent to the Under Secretary, Department of Agriculture and Stock, Brisbane. The letter should give a brief description of the problem involved—for example, a particular crop may not be growing satisfactorily. In such a case, the condition of the crop should be described. Where a farmer desires to grow a crop with which he is not familiar, he should give a general description of the area, and the depth and colour of the soil.

A soil sample should not be sent with the first enquiry. If a soil analysis is considered necessary by the Department, the farmer will be notified to that effect and supplied with directions for taking the sample.

The Honey Flora of South-eastern Queensland.

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 320 of the June issue.*)

Caley's Ironbark.

Botanical Name.—*Eucalyptus caleyi* Maiden.

Other Common Name.—Drooping ironbark.

Distinguishing Features.—An ironbark with alternate, not paired, grey or silvery leaves on distinct stalks, buds with the lid narrower and

Plate 80.

Caley's Ironbark (Eucalyptus caleyi). Leaves, flowers, buds and fruits.

scarcely as long as the rest of the bud and shining pear-shaped seed-capsules with the valves not showing (Plates 80–81).

Description.—This is a tree up to about 40 ft. high with blackish, hard, rough and deeply furrowed bark. The leaves are borne alternately along the twigs on fairly long stalks; they are greyish green or silvery, about 3–5 in. long, mostly 2–4 times as long as wide but sometimes nearly round, especially on the suckers. The flowers are borne in small bunches close to, and at the ends of the twigs, about ½ in. wide, creamy white or sometimes pinkish; the lid is conical, almost as long as the rest of the bud and slightly narrower than it. The seed-capsules are nearly pear-shaped, tapering to their stalks, nearly ½ in. long, nearly ¼ in. wide, shining dark brown.

Distribution.—Southern parts of the Darling Downs District, often on sandy or stony soil, often forming pure stands.

Usual Flowering Time.—June–October.

Colour of Honey.—Bright light amber.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Nil.

General Remarks.—Caley's ironbark produces a choice honey and, in competition with the outstanding yellow box honey, pure samples have taken championship honours at Agricultural Shows. The honey is exceptionally clear and dense, with an excellent sweet flavour; it granulates rapidly with a smooth transparent grain.

Due to a lack of pollen for broodrearing, colonies working this species often dwindle seriously.

Plate 81.

Caley's Ironbark (Eucalyptus caleyi). Oman-ama.

Hickory Wattle.

Botanical Name.—Acacia aulacocarpa A. Cunn. ex Benth.

Other Common Name.—Brown salwood.

Distinguishing Features.—This is bushy-headed, grey-looking wattle with pale-yellow flower-spikes (Plates 82-83). Its "leaves" are very like those of the Brisbane black wattle except for the colour, and the twigs also are less sharply angled.

Description.—This is a grey-looking tree up to 40 ft. but usually less than 30 ft. high, with slender, slightly but distinctly triangular twigs. The bark is grey, nearly smooth on small trees, but furrowed on the larger trees. The "leaves" are curved, narrowed to both ends, usually 3-4 in. long, about $\frac{1}{2}$-1 in. wide, with numerous parallel veins, of which some are thicker than the others, and of these one or two fuse with the margin above the base. The flowers are very small, densely packed in pale-yellow spikes 1-2 in. long and $\frac{1}{4}$ in. thick, fluffy because of the very numerous stamens hiding the tiny sepals and petals. The pod is flat, 1-2 in. long and $\frac{1}{2}$-$\frac{3}{4}$ in. wide, irregular in shape.

Distribution.—Widely distributed in the Moreton, Wide Bay and Burnett Districts, chiefly in forest country, but also very commonly forming pure stands in cleared forest country or on country formerly carrying dry scrub. It sometimes occurs in the scrub itself, and is widely distributed in eastern and northern Australia.

Usual Flowering Time.—August-September.

Importance as Source of Honey.—Nil.

Importance as Source of Pollen.—Medium.

Plate 82.

Hickory Wattle (Acacia aulacocarpa). "Leaves" and flowers.

General.—Apiaries situated near hickory wattle may obtain good supplies of pollen during spring. During early flowering, blossoms are worked heavily but once the flower-spikes commence to wilt the species is quickly abandoned. In dry periods, hickory wattle does not attract bees, although flowering may be profuse.

The light yellow pollen is a poor food, and although large quantities are gathered broodrearing is not proportionately stimulated.

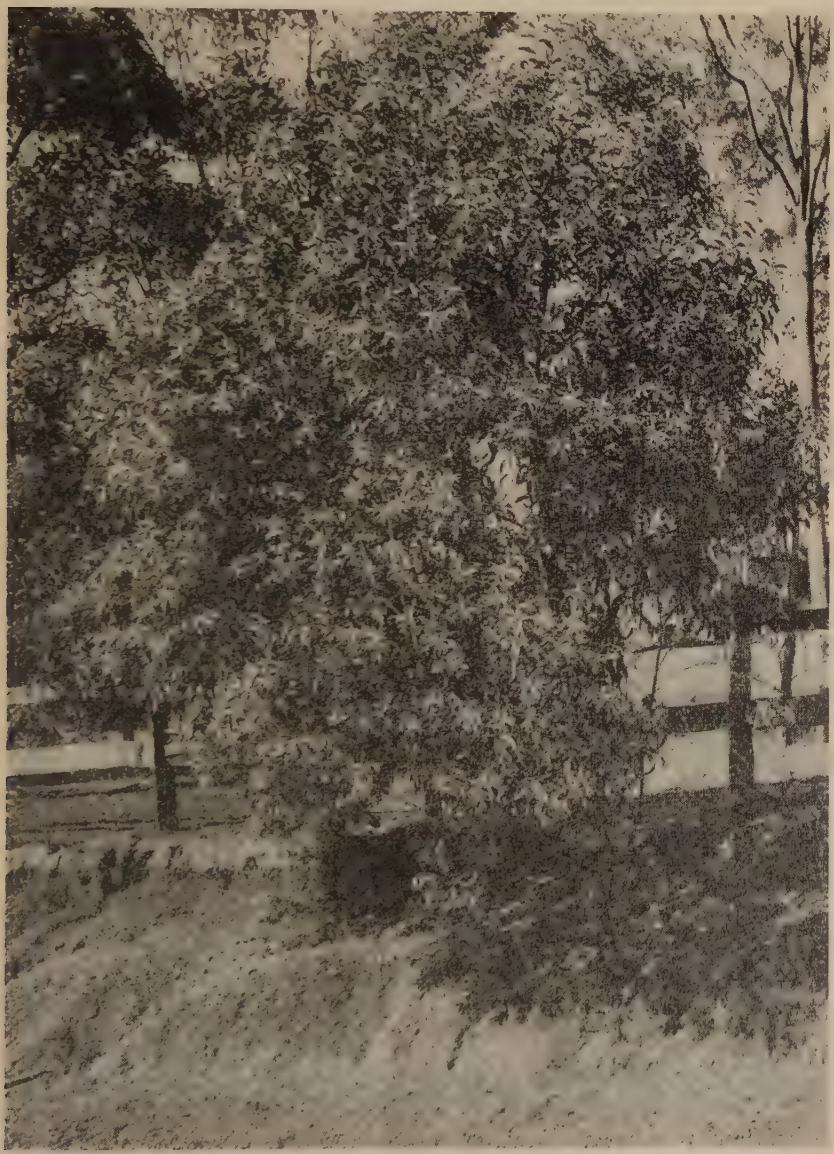


Plate 83.

Hickory Wattle (Acacia aulacocarpa). Belmont.

Brisbane Golden Wattle.

Botanical Name.—Acacia fimbriata A. Cunn.

Distinguishing Features.—A bushy-headed dark-green wattle with narrow "leaves" about 1–1½ in. long, each with one principal vein (midrib), and bunches of balls of yellow flowers (Plates 84-85).

Description.—A bushy, often broad, tall shrub or tree up to about 20 ft. high, with drooping branches and rough dark bark. The "leaves" are dark dull green, quite narrow, mostly about 1–2 in. long and $\frac{1}{20}$–$\frac{1}{5}$ in. wide, with a central midrib. The flowers are densely packed into fluffy bright yellow balls about $\frac{1}{3}$ in. wide, and the balls are carried in sprays towards the ends of the twigs. The numerous fluffy-looking stamens hide the tiny sepals and petals. The pod is flat, 2–3 in. long and about $\frac{1}{4}$ in. wide, very thin at the edges, thicker about the seeds.

Distribution.—Moreton, Wide Bay, and Burnett Districts, and the eastern parts of the Darling Downs District, chiefly along creek banks, sometimes as undergrowth in forest country. It extends to northern Queensland and is in north-eastern New South Wales.

Usual Flowering Time.—July–September.

Importance as Source of Honey.—Nil.

Importance as Source of Pollen.—Medium.

General.—Brisbane golden wattle often flowers early in spring and is a useful source of pollen at a time when this bee-food is short. Like other wattle pollens, however, its food value is only moderate, and in dry periods the flower-heads are not worked by bees.

Plate 84.

Brisbane Golden Wattle (Acacia fimbriata). Mt. Gravatt.

Plate 85.

Brisbane Golden Wattle (Acacia fimbriata). Branchlets with "leaves" and flowers.

Brisbane Black Wattle.

Botanical Name.—Acacia cunninghamii Hook.

Other Common Name.—Black wattle.

Distinguishing Features.—This is a wattle about 15–20 ft. high with sharply triangular twigs, dirty green curved "leaves" having numerous veins parallel to one another, one or two of which run into the margin above the base, and with spikes of rich yellow flowers (Plates 86-87).

Description.—A shrub or tree up to 20 ft. high with rough, somewhat blackish and furrowed bark. The twigs are sharply triangular. The "leaves" are about 5–7 in. long and 1–2 in. broad, curved almost like a reaping-hook, narrowed at both ends, with several nearly parallel veins, some thicker than others, and of these one or two run into the edge a little above the base. The flowers are very small, densely packed

in slender bright yellow spikes 1½–3 in. long and ¼ in. wide, fluffy because of the very numerous stamens hiding the tiny sepals and petals. The pod is long, curly or twisted, about ¼ in. wide.

Distribution.—Widely distributed in south-eastern Queensland in cleared or uncleared forest country, chiefly on sandy or stony ground, often forming pure stands. It is widely distributed in Queensland and north-eastern New South Wales and is also in the Northern Territory.

Usual Flowering Time.—June to September.

Importance as Source of Honey.—Nil.

Importance as Source of Pollen.—Medium.

General.—In coastal areas, Brisbane black wattle has a good reputation as a pollen plant but further inland yields decrease. This wattle provides pollen, which assists broodrearing, in the early part of spring.

The pollen has only a moderate food value, and in dry periods is not gathered by the bees.

Plate 86.

Brisbane Black Wattle (Acacia cunninghamii). Branchlets showing flowers and "leaves".

Plate 87.

Brisbane Black Wattle (Acacia cunninghamii). Western Creek, Millmerran District.

[TO BE CONTINUED.]

Index to Vol. 77.

The index to Vol. 77 of the Journal (July-December, 1953) is now available. Application should be made to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Brucellosis—Tested Swine Herds.

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

TESTED HERDS (As at 15th June, 1954).

Berkshire.

S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
R. G. Koplick, "Melan Terez" Stud, Rochedale
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
E. Pukallus, "Plainby" Stud, Crow's Nest
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington Stud, Underwood Road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, "Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Bardell," Goovigen
R. E. Paulsen, "Crest" Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, "Felbar" Stud, Kalbar
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. J. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudeser

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. G. Koplick "Melan Terez" Stud, Rochedale
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
M. D. Power, "Ballinasloe" Stud, Swan Creek, via Warwick
H. L. Larsen, "Oakway," Kingaroy
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
Mrs. I. G. Utting, "White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum Kingaroy
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney "Talgai" Stud, Clifton
F. K. Wright, Narangba, N. C. Line
O. B. Vidler, Manneum, Kingaroy

Tamworth.

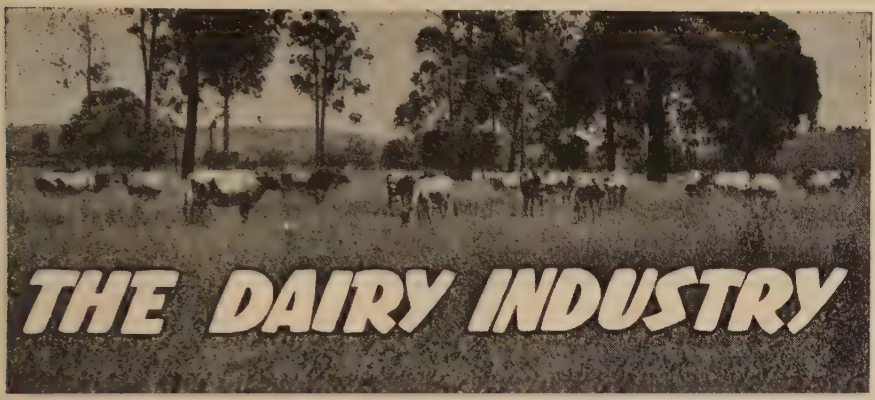
S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub *via* Beenleigh
R. G. Koplick, "Melan Terez" Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
P. V. Campbell, "Lawn Hill" Stud, Lamington
H. J. Armstrong, Alhambra," Crownthorpe, Murgon

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
D. Kay and P. Hunting, "Kazan" Stud, Goodna
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
A. Curd, "Kilrock" Stud, Box 35, Jandowae
F. K. Wright, Narangba, N. C. Line
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goombungee
G. J. Cooper, "Cedar Glen" Stud, Yarraman
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
A. H. Groves, "Kinvara" Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea" Stud, Murgon
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank

British Large Black.

W. F. Ruhle, "Felbar" Stud, Kalbar



The Manufacture of Cheddar Cheese in Queensland.

By E. B. RICE and T. A. MORRIS, Division of Dairying.

(*Continued from page 362 of the June issue.*)

THE GRADING OF CHEESE.

Requirements of a Cheese Grading System.

The ultimate verdict of whether a cheese is good or bad comes from the consumer. He is the one who has to be pleased and thus his fancies should receive first consideration. Unfortunately, there is not complete agreement among all cheese consumers as to what determines the grade of cheese. This variation in preference is likely to occur between different localities and thus it is necessary, when grading cheese, to know the requirements of the market on which the cheese will be ultimately sold.

Therefore, one of the first requirements of a cheese grading system is that it should give consideration to the fancies of the consumers in the area in which the cheese is to be sold.

Secondly, the system must be capable of attaining consistency. This is necessary in order to obtain the confidence of buyers that a uniform product will be delivered. Unless the same cheese can be repeatedly graded the same score, the grade allotted has no significance.

The system must be readily applicable. There should be no complications, any tests used should be simple and conclusive and the labour requirement to operate the system should be small.

It is important that the basis of grading be readily understood, as a system which has meaning only to the few persons concerned with its actual operation is not likely to be acceptable.

For the satisfaction and guidance of the cheesemaker, the system should be designed to clearly indicate where any defects in the cheese lie. Thus it is necessary to differentiate between the various attributes of a satisfactory cheese.

The Queensland System of Grading Cheese.

In Queensland cheese is examined and allotted points for:—

(1) Flavour and Aroma, as noted by taste and smell.

(2) Body and Texture. Body is the consistency or feel of the cheese. Texture refers to the appearance or compactness of the cheese.

(3) Condition.

The maximum points for determining cheese grades are:—

Flavour and aroma	50 points
Body and texture	30 points
Condition (including colour, salting, finish and packing in package)	20 points

The Dairy Produce and Commerce (Trade Descriptions) Acts prescribe four grades of cheese:—

Choice	Cheese scoring 93–100 points inclusive
First Grade	Cheese scoring 90– 92 points inclusive
Second Grade ..	Cheese scoring 86– 89 points inclusive
Third Grade	Cheese scoring 80– 85 points inclusive

Cheese should be at least 14 days (The Commerce Act states 21 days) old before grading. Grading at an earlier age is unreliable and misleading, as defects in flavour, smell and colour are not always apparent in freshly-made cheese.

To draw a plug of cheese for grading, the cheese trier is inserted for almost the full length of the iron into the top of the cheese, turned once and withdrawn. A piece of the cheese is then broken off the trier and the rind-end of the plug is replaced.

The temperature of cheese at grading should be between 60° and 70°F. This is important, as the body is judged by feeling between the thumb and fingers. At temperatures below 60°F. the body of well-made cheese appears to be hard and at temperatures above 70°F. it appears to be weak, soft and greasy. As these defects (hard, weak, soft and greasy body) are common defects of inferior cheese, it is apparent that a well-made cheese graded at unsuitable temperatures may be penalised for defects which are not present. Also, it is very difficult to judge both flavour and smell at low temperatures.

Cheese should be graded under good lighting conditions. Good natural light is the most suitable for grading. The colour of the cheese on the trier should be clearly defined, semi-translucent and regular. Excessive acidity dulls the colour.

When grading cheese for flavour, the sense of smell is depended upon more than that of taste. Continual tasting not only dulls the sense of taste but also that of smell. However, bitterness can only be detected if the cheese is tasted.

The method of smelling cheese for grading is:—

(1) Smell the trier plug of cheese immediately it is drawn from the sample.

(2) Smell again after crushing and warming a piece of the cheese between the thumb and fingers.

The points which may be allotted, the terms used for flavour for each grade of cheese, and the descriptive terms used for body and texture, colour and condition, on the score card used by Commonwealth and State grading staffs, are set out below.

CHEDDAR CHEESE GRADING SCORE CARD.

Terms used for Flavour—

Choicest Quality.

43 points and over .. Good full cheddar flavour and aroma; sound; good acid; mild; flat; bright.

First Quality.

40 to 42 points .. Unclean; tallowy; sour; bitter; feedy; off flavour; fruity; weedy.
Use the word "slightly" before the above terms.

Second Quality.

36 to 39 points .. Unclean; tallowy; sour; bitter; feedy; off flavour; fruity; yeasty; fermented; hydrogen sulphide; weedy; offensive smell.

Third Quality.

30 to 35 points .. The same terms as for 2nd quality with the word "very."

Prohibited.

No points .. .. Extremely offensive smell; decomposing smell; lacking cheddar characteristics.

Terms used for Body and Texture.

Good; meaty; firm body.

Weak; open; mechanical holes; swiss holey; pin holey; gas holey; acid cut; greasy; fat separation; corky; dry; crumbly; mealy; soft; not pressed enough; pasty.

Terms Used for Colour.

Good; dull; too high; too pale; mixed; mottled; wavy; chalky; acid bleached.

Terms Used for Condition.

Poor finish or rough finish; badly trimmed; loose bandages; cracked rinds; mouldy; misshapen.

It is of interest to compare another system of grading cheese with the above. In the New Zealand system the factors considered and the maximum points allotted are as follows:—

Flavour	45
Body	20
Texture	20
Colour	10
Finish	5

The grades of cheese are:—

Finest	93 points and over
First	91 to 92½ points inclusive
Graded	88 to 90½ points inclusive
Second	Below 88 points

It will be noticed that a greater number of individual factors are considered in the allotting of points and that more weight is given to the effect of "body" and "texture," and slightly less to the effect of "colour" and "finish," on the grade of the cheese.

CHEESE FACTORY HYGIENE AND SANITATION.

Modern cheese factories are designed and equipped with proper and adequate facilities to enable them to be efficiently cleansed and maintained in a clean condition. Despite this, factory employees may become careless in their cleansing operations, resulting in serious deterioration in the quality of the manufactured cheese. The essentials in cheese factory sanitation are an adequate water supply of good quality, sufficient quantities of boiling water, steam and water-hose connections, wash-up troughs, suitable cleansers and good clean brushes; also the will to do a good job.

The factory building and all utensils and equipment should be maintained in good order and condition. The windows should be cleaned and the walls and ceilings kept painted with mould-resistant paint. General maintenance of buildings and equipment keeps them in good repair, ensures longer useful life and keeps expensive repairs and replacements to a minimum. Employees themselves should be clean in their habits and suitably clothed in white overalls and clean aprons. At all times, remembering that they are handling a foodstuff, they should endeavour to prevent any form of contamination from taking place and the manufacture of a choice product should be their sincere wish.

Water Supply.

A supply of water of good quality, both bacteriologically and chemically, is of considerable importance to a cheese factory. Water is needed for the production of steam, for washing equipment, floors and drains, for cooling milk after pasteurisation and for such other purposes as the cooling of condensers on refrigerating units.

Most cheese factories in Queensland have to rely on bores for their water supply. Though usually of good bacteriological quality, this water is often hard. Samples of bore-water from the various cheese factories have been found to range in total hardness from 20 to 2,000 p.p.m. (100 p.p.m. total hardness is regarded as being the limit for "soft" water.) The hardness is caused by the presence of soluble salts of calcium and magnesium which form insoluble compounds with soap; hence the occurrence of scum when soap is used with hard water. It is almost impossible to obtain a bright finish on equipment washed with such water. Although the use of a wetting agent with a detergent in the water prevents the formation of scum and facilitates cleaning, the rinse water will dry off to leave a white film of mineral deposit on the surface of equipment.

The use of hard water for boiler-feeding purposes is very undesirable, as it leads to the formation of scale on the heating sections of the boiler, thus considerably reducing the steaming efficiency. Damage as a result of local overheating and corrosion may also result. There is probably more than one factory which could have paid for water-treatment plant several times over with the money spent on boiler overhauls necessitated by the use of hard water.

There are two systems of treatment commonly used. They are (*a*) the zeolite or base exchange system, and (*b*) the lime-soda system. The zeolite process can very effectively eliminate the hardness of water but it does not reduce the salts content. For this reason the lime-soda process is often preferable.

The Brisbane Dairy Research Laboratory of the Department conducts a free water-testing service for the dairy industry and supplies recommendations and details regarding the systems of water-treatment. This service can be availed of by submitting a sample of water to the Laboratory for testing.

General Cleaning.

The Receiving Platform.—In order to facilitate cleaning, the receiving platform should be constructed of concrete and be properly drained; a concrete approach should be provided to a depth of 15–20 ft. The cleansing and sterilizing of all weighing vats, chutes, strainers, &c., should be carried out immediately after all the milk has been received. The platform and approach should also be hosed down and cleansed.

Manufacturing Room Floors and Drains.—Each day the floors of the making and pasteurising room should be scrubbed with very hot water and soda and afterwards hosed with hot water; drains and sumps should receive similar treatment. In addition, floors and drains should be kept flushed clean during the day by using buckets of hot water or by hosing. Floors should be protected against whey by ejecting it directly from the vat outlet or running it into a stainless steel-lined, or tiled, drain and sump.

Cheese Curing Room.—Curing rooms should be properly ventilated, and where refrigeration and air conditioning are not provided the vents should be kept open at night to allow the circulation of the cool night air, and closed during the heat of the day to prevent a rise in temperature. The floors must be maintained in a clean condition, and shelves for the storage of cheese taken down regularly and scrubbed to remove any trace of mould and fat. Mould growth on cheese in the curing room should be kept to a minimum by adequate ventilation and proper remedial measures. Periodic fumigation with approved fumigants may also be necessary to control mites if cheese is stored for any length of time.

Starter Room.—A separate room is necessary for starter propagation and this room must be kept scrupulously clean and used only for the purpose intended. This is very important. There should be an ample supply of water and steam to this room.

Sanitary Conveniences.—Unless a septic system is provided, conveniences must be fly-proofed and receive regular attention in cleansing. Ample supplies of disinfectants, sawdust or ashes should be provided. Employees' hands must be washed after visiting the

conveniences. This is essential where food for human consumption is being handled. A hand washbasin and towels should be provided as near as possible to the exit from the conveniences.

Testing, Storage and Crating Rooms.—These rooms should be kept clean and tidy, as their condition often spoils the appearance of an otherwise attractive factory. Untidiness has a strong tendency to spread from one department of a factory to another.

Factory Surroundings.—Particular care must be taken to see that all surroundings are kept in a clean and tidy condition. The boiler room and boiler should be maintained in a clean condition and the ashes removed daily to a suitable ash pit. Timber and firewood should be neatly stacked at a distance from the main building. Weeds should be kept to a minimum and an occasional hoeing and raking of any accumulated growth should be carried out. Old curd and bandage trimmings should not be thrown onto the floor or outside the doors, but deposited into a bin and each day taken to the factory boiler room and burned in the boiler. A pride of ownership should prevail and the surroundings be made attractive by shrubs and planned lawns.

Whey Tanks and Surroundings.—Whey tanks should be emptied each morning. Particular care should be taken to ensure that the whey tanks, together with whey pipe-lines and hose connections, receive daily cleansing. Surroundings of the whey tank should be cemented and drained to a sump to allow for cleansing. No matter how careful farmers may be, some whey is spilt, and when the soil at the whey tanks becomes saturated with whey it causes objectionable smells and becomes a breeding ground for flies.

Disposal of Waste Water.—The disposal of factory waste water is difficult at many cheese factories, the usual practice being to eject this water some distance from the factory onto land that has been ploughed to absorb the water. The outlet is moved frequently to allow the surplus water to seep away and dry out, and to avoid bogging of the area, which may cause bad smells and promote the breeding of flies. It is advisable to lime the drainage area frequently to keep it sweet. It should be kept bare of weeds and grass to allow for rapid evaporation and absorption.

Cleansing of Cheese Factory Equipment.

Pasteurisers and Coolers.—With the double-dome type of pasteuriser an external cooler is necessary, while the plate type of heat exchanger allows heating and cooling to be carried on in the one machine. The principle of cleaning is the same in both cases. Essentially it entails the circulation of cold to warm rinse water, the circulation of hot detergent solution, scrubbing with a detergent solution, and finally the circulation of hot rinse water.

The most convenient arrangement is to have a small balance tank fitted with water and steam droppers and connected to the raw and pasteurised milk lines by means of two 3-way cocks. After the completion of milk treatment, water is allowed to run into this tank, or the receiving vat, and is then pumped through and over the equipment to remove any remaining milk. This rinse water is run to waste and a 0·5% caustic soda solution, or any satisfactory commercial detergent in solution, is prepared in the balance-tank and heated to 160°F. The detergent solution is circulated through and over the equipment, being

maintained at a temperature of 160° F. in the pasteuriser and in the balance-tank, for 20–30 minutes. The circulation is stopped, the machine is opened up and all surfaces exposed to milk, including pipelines, are brushed with the detergent. The machine is then reassembled and clean warm rinse water is passed through to flush away the detergent solution. This rinse water is circulated after allowing the first flushing to run away, and the temperature is raised to 180° F. and maintained at that for five minutes or more. The water is then allowed to run away and the pasteuriser is loosened and drained.

The above method of cleaning a pasteuriser may be simplified if a plate machine with all stainless steel fittings is in use and a supply of soft water is available. All surfaces to be cleaned in the pasteurising circuit must, without exception, be of stainless steel; otherwise corrosion will result when the following labour-saving method is employed. After carrying out the first rinsing a 0·1% nitric acid solution is prepared in the balance tank and is circulated at 160° F. for 20 minutes. This is then flushed out with clean water and a solution containing 0·5% caustic soda and 0·1% trisodium phosphate is prepared and circulated at 160° F. for 20 minutes. This solution may be saved for other cleaning purposes. The pasteuriser is again rinsed with clean water and just prior to milk treatment a chlorine solution (200 p.p.m.) is circulated for 5 minutes and drained away or run into the vats and made up to sufficient strength (400 p.p.m.) for the chlorination of these and the agitator blades.

Cheesemaking Vats.—Making vats should be rinsed clean and then scrubbed with a detergent solution as soon as they are emptied. They should be finally rinsed with very hot water.

Cheese Moulds, Hessian, Presses, Bandages, &c.—Cheese moulds should be scrubbed each time the cheese is removed, and then scalded. They should be retinned when necessary to avoid rust marks on the finished cheese bandage. Outer bandages and bag ends should be boiled daily and renewed regularly. Presses should be thoroughly cleansed and oiled and periodically painted with a rust-resistant paint.

Sterilization of Cheese Factory Equipment.

There are two methods of sterilizing cheese factory equipment. One is by the application of heat and the other is by the use of chemical sterilizers.

Steaming is the common means of heat sterilization. Pipelines and items of equipment which may be wholly or partially sealed may be effectively sterilized in this manner. However, open equipment such as surface coolers and vats is very difficult to sterilize by this means because of the difficulty in raising its temperature high enough for a sufficient length of time to ensure practical sterilization. Thus it is often found that the most suitable method of sterilizing equipment is by the use of chemical rinses. Chlorine in solution is commonly used.

A satisfactory stock solution (of a strength of about 20,000 p.p.m.) for the preparation of chlorine rinses may be prepared as follows:

Dissolve 1½ lb. of soda ash in 1 gallon of slightly warm water. Stir in 1 lb. of common salt and 1 lb. of bleaching powder and stir at intervals during the next one to two hours. Finally allow the solution

to stand until the next day, when the clear liquid should be run off into stoppered bottles and the sediment discarded. Store the solution in a cool location.

Chlorination of the equipment should be carried out just prior to milk reception and not immediately after cleaning at the end of the day. This is so not only because of the possibility of the occurrence of contamination during the intervening period but also because of the danger of corrosion when a chlorine solution is left in contact with equipment (other than stainless steel) for some time. A satisfactory general system is to make up the chlorine solution in the receiving vat by adding one part of the stock solution to 50 parts of water. This gives a strength of about 400 p.p.m. The solution is then pumped through the pasteurising and cooling system and a small quantity is run into each vat. (If the solution is to be circulated through the pasteuriser for some minutes, a strength of only 200 p.p.m. should be employed, as recommended above for the cleaning of pasteurisers.) The vat surfaces and the blades of the agitators are thoroughly brushed with the solution. All items of equipment which contact the milk should be similarly treated. The pasteuriser, vats, etc., should then be drained or brushed free of the chlorine solution but not rinsed unless a chlorinated water supply is being used.

A wetting agent used in conjunction with the chlorine solution increases its germicidal efficiency and thus a weaker solution may be used However, the danger of corrosion is increased.

[CONCLUDED.]

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Thermoduric Bacteria in Milk.

By W. F. SCHUBERT, Biochemist, Division of Dairying.

Probably the most interesting but also on occasions the most destructive form of lower life is the class of organisms to which we give the name of bacteria. These are actually single-celled plants which are so small that they cannot be seen without the aid of a microscope.

Some idea of their size may be gained from the fact that 25,000 of them placed side by side would be necessary to measure a single inch. In addition, each bacterium weighs so little that we should have to collect millions upon millions of them to have sufficient numbers to weigh a single ounce.

However, what bacteria lack in size they make up for in other directions. Firstly, they are able to reproduce themselves at an alarmingly rapid rate. If conditions are favourable one cell can produce well over a million descendants within 24 hours. Secondly, bacteria though very small can bring about widespread damage in our common foodstuffs unless steps are taken to check their activities.

Contrary to a widespread belief, not all bacteria are harmful to human beings. As a matter of fact, bacteria make life possible upon the earth. Those that live in the soil are responsible for the decay of plant and animal tissues and thus make food materials available for the higher plants, but many bacteria are undesirable in foods because their activities result in spoilage and consequent economic loss.

Now, milk as it comes from the udder of the cow contains relatively few bacteria, but once the milk has been drawn bacteria seek to establish themselves in the milk supply, and unless special precautions are taken they will destroy its food value for man. Milk is an ideal food for bacteria as it contains all the carbon, nitrogen, and other food ingredients which bacteria require to grow and multiply.

Modified Methylene Blue Test.

One of the tests now widely used to gauge the bacterial content of raw milk is the modified methylene blue test. In this test a small quantity of the dye methylene blue is added to a sample of the milk and the whole incubated at blood heat. The time taken for the dye to decolourise is an indication of the bacteriological quality of the milk. All farmers who supply milk to the market milk trade are now thoroughly familiar with this test.

However, in recent years, it has been discovered that the test has certain limitations. For example, it is now known that the methylene blue dye is not sensitive to a class of bacteria for which bacteriologists have coined the word thermoduric (that is, heat resistant).

Thermoduric bacteria are undesirable in milk, because they are usually the result of unhygienic conditions on the farm, and, being heat resistant, they contribute to the total bacteriological count of the pasteurised product.

Characteristics of Thermoduric Bacteria.

Thermoduric bacteria belong to the genera Microbacterium, Micrococcus, Streptococcus, and the sporing genera. Since these organisms do not influence the modified methylene blue reduction time to any appreciable extent, less emphasis must be placed on this test, and more emphasis must be placed on laboratory pasteurisation counts when these organisms are under consideration.

Such organisms are able to resist pasteurising but not sterilizing temperatures. Hence the incorrect application of heat on the farm will result in a "build-up" of these organisms on the utensils and the subsequent contamination of all milk which comes in contact with them.

Thermoduric bacteria are usually associated with milk-soiled dairy utensils. Careless methods of cleansing and sterilizing will result in a "build-up" of these bacteria.

Testing for Thermoduric Bacteria.

The test for thermoduric bacteria is to pasteurise the milk sample and then make a colony count. The colony count is made by first diluting the milk sample with sterile water and then placing a small quantity of the milk in a flat glass vessel called a Petri dish. A jelly-like substance called agar which contains all the necessary food requirements of bacteria is then mixed with the milk and the whole allowed to set. The dish is then incubated for three days at 30°C. Bacteria are invisible to the naked eye but on incubation they grow into colonies which appear as specks in the clear agar. A count of the specks constitutes a colony count.

The following illustration by Dr. C. Dukes may make the method more clearly understood. "The seeds of some plants are very small, but even if they were so small as to be invisible to the naked eye, we could still find out how many were present in a fine powder by sprinkling it beneath the soil level in a fertile patch of ground and then counting the number of plants which appear a few weeks later. The individual bacteria in the milk are like invisible seeds and the colonies which develop correspond to the visible plants."

In order to obtain reliable results by the above method it is important that a standardised technique be used.

Determining Thermoduric Counts.

Five millilitres of the well mixed sample are transferred to a sterile, rubber-stoppered, 6 in. by $\frac{5}{8}$ in. test tube and the whole completely immersed in a water bath at 63–65°C. (145-148°F.) The tubes are held in the bath for 35 minutes, including the 5 minutes allowed for the contents to warm up. The tubes are then withdrawn and immediately cooled to below 50°F. After this procedure, which is designed to reproduce commercial pasteurisation conditions, the samples are diluted and plated on tryptone-glucose agar. The plates are incubated at 30°C. for 72 hours. Each colony of bacteria developed on the plate represents initially one bacterium and the total count is reported per millilitre of milk.

Interpretation of Results.

The Health Act of Queensland states that pasteurised milk shall not contain more than 50,000 organisms per millilitre. If farm utensils are efficiently cleansed and sterilized, no difficulty is experienced in satisfying this standard. Very high counts indicate a heavy build-up of thermoduric organisms due to unsatisfactory cleansing and sterilizing of farm utensils.

Faults in Cleansing and Sterilizing.

It is not always appreciated that it is extremely difficult to cleanse and sterilize badly pitted and neglected dairy utensils. Bacteria lodge in the cracks and crevices and defy all efforts to remove them. These bacteria "seed" the milk as it flows over the utensils.

Rubberware which has deteriorated harbours millions of bacteria. These cannot be removed and the only remedy is to replace the rubberware.

Thus the first essential for producing milk free of thermoduric bacteria is to ensure that all equipment with which the milk comes in contact is in first-class condition.

Milkstone if allowed to build up in machines harbours thermoduric bacteria which enter the milk supply as soon as milking commences.

Milk residues, usually found associated with improperly cleaned rubberware, also contribute large numbers of bacteria to the milk.

The use of lukewarm solutions for cleaning instead of solutions at the recommended temperatures contributes largely to the build-up of thermoduric bacteria. Generally, the use of any bacteriological agent or condition at the incorrect level results in bacteriological trouble on the farm.

When the bulk supplies exhibit a high count, individual farmers' milks are tested with the object of pinpointing the farms on which the washing-up methods are unsatisfactory.

Table 1 illustrates the application of the thermoduric count. The tanker milk from a certain district exhibited a high bacteria count and the individual farmers' milks were tested with the object of pinpointing the farms on which the washing-up methods were unsatisfactory. These farms were visited by a dairy officer and a week following his inspections counts were again made.

TABLE 1.

COLONY COUNTS SHOWING RESULTS OF FIELD INSPECTION FOLLOWING LABORATORY PASTEURISATION OF PRODUCERS' SAMPLES OF MILK.

Producer.	Colony Count on Laboratory-Pasteurised Sample.	
	Before Field Inspection.	One Week Following Field Inspection.
1	Over 300,000	50,000
4	200,000	Below 30,000
5	210,000	40,000
9	300,000	65,000
11	100,000	30,000
12	250,000	Below 30,000
16	280,000	60,000
18	Over 300,000	30,000
19	Over 300,000	40,000
21	270,000	45,000
23	Over 300,000	50,000
28	180,000	35,000
29	220,000	Below 30,000
30	290,000	65,000
33	200,000	45,000

Eradicating Thermoduric Contamination.

(1) Use all cleansers at the correct strength.

(2) Use all solutions at the correct temperatures.

(3) Clean every utensil thoroughly.

(4) Correctly sterilize all equipment.

Application of Thermoduric Tests.

The chief application of the thermoduric test is in farm advisory work.

Effect on Keeping Quality.

As far as is known thermoduric bacteria have little effect on the keeping quality of pasteurised milk. However, some of the spore-formers which produce a rennet-like enzyme are responsible for the defect known as sweet curdling.

RENEW YOUR JOURNAL SUBSCRIPTION EARLY.

Journal subscribers are requested to renew their Journal subscriptions well in advance of the month of expiry, as it is often difficult to provide missing numbers.

Bucket and Nipple Feeding of Calves.

By N. HOYER and R. M. LARKIN, Cattle Husbandry Branch.

Along with other investigations carried out at the Kairi Regional Experiment Station in North Queensland on problems of calf rearing and dairy husbandry practices, observations have been made over the last three seasons on the relative merits of two systems of calf feeding.

This work on calf feeding has involved the use of two groups of Jersey calves reared identically except for the manner in which the milk was fed. One group was fed straight from the bucket in the manner normally practised by dairy farmers, and the other group was fed with a "nipple feeder", which is designed to give the calf the impression of a cow's teat at which it can satisfy its desire to suck.

This method of calf feeding is used in overseas dairying countries and has been practised on a limited scale in Queensland.

As well as observations on the nipple feeder designed originally for this trial, some observations have been made on two commercial types of nipple feeders

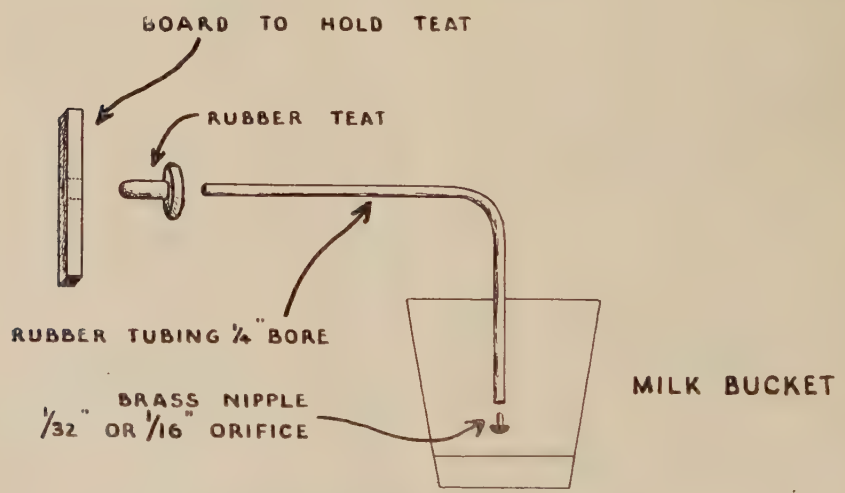


Plate 1.

Diagram of Parts of Nipple Feeder.

which are in use in U.S.A. (Calf-Teria patent) and England (Rose Miller patent).

The nipple feeding apparatus used in the trial (Plate 1) consisted briefly of a rubber teat, a length of rubber tubing of ¼ in. bore, and a brass nipple to restrict the flow of milk.

For the first year the nipple used had an orifice of 1/32 in. and in subsequent years 1/16 in.

The teats are passed through a 6 in. x 1 in. board and held securely by a flange at the end so that the calf can suck. The rubber tubing is led from the teat into the milk bucket.

1950-51 Season.

0-24 hours—Calf on mother.

2-5 days—Mother's milk—1 lb. milk per 10 lb. liveweight per day.

5-10 days—Wholemilk at above rate.

10-14 days—Change to skim milk.

3-5 weeks—10 lb. skim milk per day.

6 weeks—12 lb. skim milk per day.

7-9 weeks—13 lb. skim milk per day.

10-14 weeks—14 lb. skim milk per day.

14-24 weeks—16 lb. skim milk per day.

Plate 2.

Calf Drinking from the Calf-Teria Nipple Feeder.

Plate 3.

Calf Drinking from the Rose Miller Nipple Feeder.

The commercial types are shown in Plates 2 and 3. These differ from the feeder described in that a valve is incorporated in the teat and milk flow is not restricted to the extent achieved by the use of the brass nipple in the design used in this trial.

MANAGEMENT DURING TRIAL.

All calves in both groups received the same treatment as regards amount of milk and supplements fed; they also grazed the same pasture.

The feeding routines followed in each of the three years were as follows.

1951-52 and 1952-53 Seasons.

The calves were fed in the same way as in 1950-51 until 14 days old, after which the amount of milk fed was calculated at the rate of 1 lb. milk per day per 10 lb. liveweight until a maximum of 16 lb. milk per day was reached.

During 1950-51 a crushed grain supplement was fed to the calves from the time they started eating until a maximum of 3 lb. per day per calf was fed. A similar procedure was followed in the 1952-53 season, but a maximum of only 1½ lb. of crushed grain per calf per day was fed. In

1951-52 no grain supplement was given until pasture conditions had deteriorated in May, and then 1½ lb. of crushed grain was fed per calf per day.

During the 1950-51 and 1951-52 seasons, lucerne hay or chaff was provided in various quantities depending on the pastures available. No lucerne hay or chaff was provided during the 1952-53 season.

The age at weaning of calves off milk varied somewhat according to season, but weaning at 6 months of age was the general aim, and in the comparison of results the body weights at this age are considered.

OBSERVATIONS.

Teaching Calf to Drink.

It has been noticed over the period of this trial that calves learn to drink efficiently from the nipple feeder and from the bucket in approximately the same time, and on the average about three feeds were sufficient to teach the calf to drink.

Only a few calves have been fed with the two commercial feeders, but it seems apparent that calves learn to drink efficiently more quickly with the Calf-Teria patent than with the Rose-Miller patent.

Time Taken to Drink Milk.

During the 1950-51 season, when a brass nipple of 1/32 in. orifice was used, it was found that calves took 12-20 minutes to consume 8 lb. of milk, which was the greatest amount fed in one feed. This was considered to be too slow. With the increase in the size of the orifice in the nipple to 1/16 in. in the 1951-52 and 1952-53 seasons, a period of 9-14 minutes was required for a calf to drink 8 lb. of milk.

Calves fed from an open bucket were found to take 1-3 minutes to drink 8 lb. of milk.

With the two commercial types of feeders the period taken to drink a given quantity of milk was intermediate between the times taken by bucket fed calves and those drinking from the nipple feeder with 1/16 in. orifice.

There is a maximum time period beyond which a calf will not suck and this limit was apparently reached in the 1950-51 season using a nipple of 1/32 in. orifice. On some occasions calves would tire of sucking and would consequently leave some milk, and one calf in particular weaned itself entirely off milk after a short period.

The time spent by a calf drinking influences its desire to suck. This sucking urge is usually satisfied by the calf sucking the extremities of other calves.

Sucking was quite evident in the bucket fed groups, but it was possible to keep this undesirable habit to a minimum by encouraging the calves to eat hay or chaff immediately after they had finished their milk. With calves in the nipple fed group the sucking of other calves was considerably reduced, it being noticed on only a few occasions.

Bloating.

Nipple fed calves frequently exhibited a bloated effect after completing their feed. This was due to air being sucked in whilst drinking.

It was thought that this might be due to the fact that in the first two years the milk bucket was at ground level and the teat about 18 in. above the ground; however, raising the level of the bucket above the calf's head in the third season so as to give a syphoning effect did not check this tendency to bloat.

In no instance was the bloating fatal, and it soon passed off.

Disease Incidence.

Calf scours was the main disease evident during the course of these trials; otherwise only individual cases of blight and foot-rot were recorded.

In most instances when calf scours were evident a number of calves were affected at the same time, and although

during these outbreaks more calves from one group (namely the bucket fed group) were affected, it is thought that the differences recorded are not of great significance and that the incidence of calf scours was not materially influenced by the method of feeding.

During the 1950-51 season two calves from each group developed scours at the same period. During the 1951-52 season three individual cases of scours occurred; two of these were bucket fed calves and the other a nipple fed calf.

Two outbreaks of scours occurred during the 1952-53 season, in which all told nine cases of scours in bucket fed calves and five cases amongst nipple fed calves were recorded.

Weight Gain of Calves.

Figures relating to the average birthweight, weight at six months (24 weeks), gain to six months and average daily liveweight gain to six months of age are recorded in Table 1.

TABLE 1.

AVERAGE WEIGHT AND GAIN OF CALVES

	Average Birthweight.	Average Weight at 6 months.	Average Gain to 6 Months.	Average Daily Gain.
	Lb.	Lb.	Lb.	Lb.
1950–51—				
Nipple Group	50	199	149	0·89
Bucket Group	56	200	144	0·85
1951–52—				
Nipple Group	54	185	131	0·78
Bucket Group	45	172	127	0·75
1952–53—				
Nipple Group	53	178	125	0·74
Bucket Group	50	205	155	0·92

It will be noticed that the figures for the bucket fed group in 1951-52 are low. This is attributed to the fact that a dwarf calf was included in this group; had this calf been excluded, the performance would have exceeded that of the nipple group of the same year.

Differences recorded in the weight gains of the 1950-51 and 1951-52 seasons are not significantly in favour of either method of feeding, but the difference between the weight gains of the 1952-53 season could be regarded as being of a significant nature.

CONCLUSIONS.

From observations there was no visible difference between the appearance of calves in each of the groups. The weight gains recorded support this, except perhaps in the 1952-1953 season, when there was some evident difference in body size but not in appearance.

No advantage was gained from either method in the teaching of calves to drink efficiently.

The fact that nipple fed calves do not suck each other to the extent that bucket fed calves do is a commendable feature, as sucking is a most undesirable habit.

The reduced sucking by nipple fed calves is, however, bound up with the period of time the calves take to drink their milk, and it may be argued that the farmer cannot spend any considerable time in the feeding of calves. It may, therefore, be said that from a practical point of view the long feeding period necessary for calves on the nipple system is a definite disadvantage. There is, however, no reason why sucking could not still be avoided by the use of one of the commercial types of nipple feeders or by modification of the design described here to give a drinking period just long enough to attain this advantage.

The undesirable bloating effect of the nipple feeding method is a definite disadvantage and could be a serious problem.

The incidence of disease recorded amongst groups used in this trial—particularly in relation to calf scours

—is very similar for both groups, and an advantage for one method of feeding on this aspect cannot be claimed.

It could not be concluded from the figures recorded on weight gains that either method of feeding would produce better results.

A further factor which requires to be considered from a practical viewpoint is the washing of the calf feeding utensils, and in calf rearing the use of thoroughly washed and sterilized utensils is very important. The washing of buckets is a relatively simple matter and it is an operation which can be carried out efficiently and quickly, whereas the washing and sterilizing of parts used in nipple feeders is time-consuming and requires particular care. From this viewpoint the nipple system of feeding is not very acceptable to the commercial dairyman.

Therefore, it would seem that the nipple feeding method has two serious drawbacks from a practical point of view, namely:—

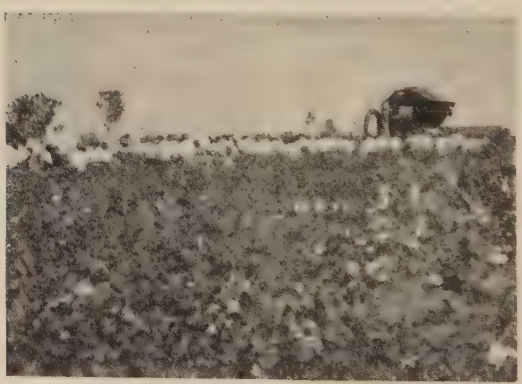
(1) The long period which would be required to feed a number of calves.

(2) The extra work involved in ensuring that the utensils are clean.

The main advantage to be gained from such a system is that the undesirable habit of calves sucking each other is eliminated.

"Growth Rates of Beef Cattle in Tropical Queensland." A Correction.

In the graph showing growth rate of steers in relation to rainfall, which appeared in the article with the above title in the May issue of the Journal, the British steers are represented by the blank rectangles and the Brahman cross steers by the crossed rectangles.



Central Queensland Farmers are shown a Mechanical Cotton Harvester in Operation at a Field Day on Biloela Regional Experiment Station.

ANIMAL HEALTH

Tuberculosis in Beef Cattle in Queensland.

By D. N. SUTHERLAND, Divisional Veterinary Officer, Townsville.

Tuberculosis is a disease of man and his domesticated animals which has been known since times of antiquity.

During recent years, considerable attention has been devoted to the eradication of tuberculosis in dairy cattle. A programme of testing of herds supplying milk and cream in the major dairying districts has resulted in a considerable reduction of the disease.

Although tuberculosis is less prevalent in beef cattle than it was in most dairying districts when the testing programme was undertaken, it is a serious problem in some herds.

TRANSMISSION.

Tuberculosis is an infectious disease, and the only means whereby an animal can contract the disease is by contact with the causal germ (*Mycobacterium tuberculosis*). Cattle affected with the disease pass out the organism in the faeces, saliva or nasal discharge. Where there are lesions of the disease in the lung, infection is spread with mucus droplets during the coughing or swallowed and passed out in the faeces. In advanced cases the milk is infective and will set up the disease in suckling calves.

Tuberculosis may gain entry by contamination of wounds with infective material or inoculated during routine vaccination against contagious pleuropneumonia with virus from a beast affected with tuberculosis.

Although cattle are by far the commonest source of spread of the disease through a herd, other species of animals are affected with tuberculosis and may play some part in its transmission. On properties where the disease is prevalent, wild pigs become infected by eating carcases and they may contaminate pasture and watering points. Deer are also susceptible, but as their distribution in Queensland is very limited, they are of only minor importance.

Although close contact is usually regarded as a prerequisite for the rapid spread of tuberculosis, it will be readily appreciated that the conditions on properties in the dry pastoral areas of Queensland are often very favourable for the spread of the disease through the herd. During the dry season, as many as a thousand head of stock may be concentrated on one waterhole or drinking trough, and at this time the resistance of many cattle to disease is reduced by malnutrition, pregnancy or lactation.

COURSE OF THE DISEASE.

When the organism enters the body it usually sets up a primary lesion in one of the many lymph glands throughout the body. The glands which are most commonly affected are those in the region of the head and throat, those in the chest cavity, and those attached to the intestines. Lesions are also found commonly in the lungs, and these are of the greatest importance so far as the spread of the disease is concerned. Other organs which may be affected are the liver, spleen, kidney and genital organs.

The lesion caused by the organism is called a tubercle and in its early stages of development it is no larger

than a pin-head. Some lesions remain small for a considerable time, but they may become active at any time if the resistance of the animal is lowered by malnutrition or other factors.

The lesions contain a yellow, cheesy material in which calcium salts may be deposited, giving it a characteristic gritty consistency.

When the resistance of an affected animal is low, the disease may spread to a number of organs, setting up generalised tuberculosis.

throat, front of the shoulder or hip, or above and behind the udder.

(4) General debility with staring coat and dull sunken eye.

In some cases the existence of the disease is not suspected until the beast is sent for slaughter, when extensive lesions may be found. In these animals, however, once the resistance is overwhelmed, the final collapse is rapid. Pregnancy often delays the appearance of gross clinical

TABLE 1.

CONDEMNATIONS FOR TUBERCULOSIS AT QUEENSLAND MEAT WORKS, 1942–1951.

Year.	Cattle Slaughtered.	Condemned.*			
		Bodies.	Per cent.	Quarters.	Per cent.
1942	559,112	3,575	0·64	75	0·013
1943	526,413	2,911	0·55	325	0·061
1944	527,269	2,281	0·43	129	0·024
1945	588,661	4,004	0·68	66	0·011
1946	415,649	3,250	0·77	94	0·022
1947	694,780	3,385	0·48	59	0·008
1948	625,789	2,970	0·47	32	0·005
1949	568,334	2,123	0·37	99	0·017
1950	586,145	2,101	0·36	77	0·013
1951	575,089	2,135	0·37	40	0·007
Total	5,668,241	28,735	0·57	996	0·017

* Carcases of which only the head was condemned are not included.

As the disease may affect any one of a number of organs and its course is influenced by the resistance of the individual animal, the symptoms shown by affected animals vary greatly. It should always be remembered that the majority of affected animals show no symptoms at all.

The following are the commonest clinical symptoms of the disease:—

(1) Difficult, snoring respiration due to a lesion in a lymph gland exerting pressure on the larynx.

(2) A persistent, soft cough with heaving sides, sometimes accompanied by an offensive nasal discharge.

(3) Enlarged lymph glands in the regions of the jaws and

symptoms, which show up following calving.

OCCURRENCE IN BEEF CATTLE.

The figures available for condemnations of carcases or parts of carcases of all cattle killed at meatworks in Queensland, as shown in Table 1, do not in themselves indicate a high incidence of the disease.

However, in interpreting these figures the following facts should be borne in mind:—

(1) The figures relate only to carcases which are affected to such an extent that the whole or part is condemned as unfit for human consumption. In the majority of carcases

affected with tuberculosis the disease is localised, and no edible portions are condemned.

(2) The cattle slaughtered at meatworks do not represent a true cross-section of the beef cattle population. They are largely young cattle in prime condition in which the incidence of disease would be lower than that of the whole herd from which they originated.

(3) The figures relate to all cattle treated at meatworks, both beef cattle and culled dairy stock. In the latter, the percentage of condemnations would be extremely low, as reactors detected by tuberculin testing are not treated at meatworks.

As would be expected, the incidence of tuberculosis in drafts of cattle from different properties shows a wide variation. Only a small number of herds showed a high percentage of condemnations; a greater number showed a low percentage of condemnations, and an even greater number showed no condemnations at all.

The highest incidence of the disease in any one draft was approximately 28% of one line of cows, and condemnations in excess of 10% were recorded in cows from several other properties. The percentage of condemnations of bullocks from properties from which these cows originated varied from 2% to 4%.

Properties which showed a high incidence of the disease were situated in widely separated areas, some being in semi-arid districts where the stocking rate is only about 20 beasts per square mile. A high incidence of tuberculosis in beef cattle herds in semi-arid areas of western Queensland has been previously reported by G. R. Moule in 1948.

TABLE 2.

CONDEMNATIONS FOR TUBERCULOSIS AT THREE NORTHERN MEATWORKS, 1953.

	Meatworks No. 1.		Meatworks No. 2.		Meatworks No. 3.	
	Males.	Females.	Males.	Females.	Males.	Females.
Total Number Treated ..	39,453	6,244	38,060	5,188	50,377	12,077
Number condemned ..	167¼	56¼	119¾	56¼	53¼	24½
Percentage	0·42	0·90	0·31	1·08	0·11	0·20

A more accurate estimate of the degree of infestation in beef cattle herds can be obtained from the figures in Table 2, showing the condemnations of male and female cattle treated at three meatworks in North Queensland during 1953.

Practically all the cattle treated at these three meatworks would be beef cattle drawn from North Queensland. The figures in this table illustrate quite clearly that the incidence of the disease is much higher in cows than in bullocks. This higher incidence is due to the fact that the average age of cows in most herds would be greater than that of bullocks and that they are subjected during their life to greater strains, such as malnutrition, pregnancy and lactation, which would render them more susceptible to infection with tuberculosis.

CONTROL.

Once the disease becomes established in a herd the only means by which it can be eradicated is by a programme of tuberculin testing.

The test generally used for diagnosis is known as the single intradermal test and is carried out by injecting into the skin of the animal a minute quantity of a product known as tuberculin and examining the site of injection 72–96 hours later. A swelling at the site of injection denotes a positive reaction.

The test has been used for many years in programmes for controlling tuberculosis in cattle in a number of countries, and it has been found to be extremely reliable and accurate when used by experienced veterinary surgeons.

To eradicate the disease from heavily infected herds, it has been found that repeated testing at short intervals is necessary. In dairy herds the ideal interval for retesting infected herds is approximately three months. It is realised that such a programme presents great difficulties in large beef herds. However, if a high degree of infection is established in a herd the reward of eradication of the disease would warrant considerable effort and expense.

In such herds, if a programme of testing is not undertaken, continual vigilance should be exercised to detect and destroy any animals showing clinical signs of the disease.

Some reduction in the incidence of the disease could also be achieved by weaning stock at an early age and keeping them segregated from the older cattle, in which a high degree of infection exists.

Various expedients such as marketing cattle at an earlier age merely reduce the losses from total condemnations without markedly lowering the degree of infection.

In herds in which the incidence of the disease is low, care should be taken not to introduce cattle which may be infected. As the major introductions into beef breeding herds are of bulls, it is a wise precaution to have all bulls tuberculin tested before introduction.

USE CLEAN DRUMS FOR MOLASSES.

Farmers who send drums to sugar mills to be filled with molasses are advised to make sure that the drums do not contain anything harmful.

During recent years several cases of illness and death in pigs and calves fed on molasses have been reported. Chemical examination of the suspected molasses showed the presence of impurities which could have been the cause of the trouble. These impurities no doubt had been introduced by using contaminated drums for holding the molasses.

It is known that drums which previously contained paint driers, carbolic preparations, mineral oils and so on have been used for holding molasses without first being thoroughly cleaned.

Suppliers of stock foods are obliged to see that no substances deleterious to health are present in their foods. Suppliers of molasses should therefore take care that drums used by them are clean before filling.

In cases where difficulty is experienced in cleaning drums intended for molasses, the drums should be rejected rather than risk illness or death of stock.

Still More Wool!

Part 6. Incorporating Fleece Measurement in Flock Improvement Programmes.

By G. R. MOULE and R. E. CHAPMAN, Sheep and Wool Branch.

Many objections have been raised against incorporating fleece measurement in flock improvement programmes. So far, none of them have been valid!

Fleece measurements can be used by stud master and flock owner alike. The stud master probably places more emphasis on future generations; the flock owner is more likely to be concerned about his immediate flock.

As the Merino industry is organised on the nucleus system, any progress made in the studs which supply rams will be reflected in the flocks which buy them. However, the merit of the flocks will be about one sheep generation behind that of the studs. Therefore, the studs are the key to the progress in sheep breeding. Unless they progress, the flocks that buy their rams will not progress.

Most of the permanent genetic improvement made in any flock will come from the selection of rams. Careful selection of rams contributes between one-third and one-half of the total improvement due to better breeding. The usual classing and selection of ewes, on the other hand, contributes only about one-twentieth to one-tenth of the genetic progress made. Therefore, for rapid improvement the rams are the key to the situation.

In finding ways of using fleece measurement, it might be worthwhile to divide the sheep industry into four classes:—

(1) The ordinary wool-growing flocks, for which the rams are purchased from studs.

(2) The ordinary wool-growing flocks which are closed to outside blood. That is to say, they breed their own rams.

(3) The stud flocks which buy in top sires from larger or older studs. However, they may also use some of their own rams. They are often referred to as "daughter" studs.

(4) The stud flocks which have been established for a long time and which are closed to outside blood. There are comparatively few of these "parent" studs in Queensland.

How Accurately Can You Select Sheep?

Sheep classers vary in their ability to select, by visual appraisal, sheep which will cut heavy fleeces. Compared with the accuracy of selection on clean fleece weight, their efficiency may be somewhere between one-quarter and two-fifths. As the rams contribute so largely to the genetic progress, it is particularly important that the extra three-fifths to three-quarters accuracy be not lost during their selection. So the time spent in weighing the rams' fleeces would well be warranted.

It may be argued that the flock owner has to decide if the effort of weighing fleeces from his ewes is worthwhile, to ensure that extra accuracy in selecting for something which will account for between one-twentieth and one-tenth of his genetic progress. However, that is not the only thing to be considered. There is the aspect of the immediate improvement resulting from selection.

After considering his flock numbers, as explained in Part 3 of this series, the flock owner may find he can cull 25% of his ewes. If his classer is 40% efficient at picking the heaviest cutters, he could expect the classer's work on 1,000 ewes to add to his clip the equivalent of about 130 lb. clean scoured wool. If he spends 60 to 70 hours in weighing individual fleeces during shearing and in sorting out the heaviest cutters, he could expect to gain about another 130 lb. clean scoured wool. If a further 400 man hours were spent in sampling and scouring, another 65 lb. clean scoured wool could be added. As a fairly large proportion of this gain is held for the lifetime of the ewes, the work involved in weighing fleeces is clearly justified.

The main advantage from selecting ewes on fleece weight is to increase the present level of production of that part of the flock which is retained. Selection on fleece weight is so effective in doing this that it would be worthwhile to class wethers this way too!

Fleece Measurement in the Hands of the Flock Master.

Fleece measurement can be used by both the flock master who buys rams from a stud and the flock master who has closed his flock and now breeds his own rams. The former is restricted to using it in the selection of ewes. Because the clean scoured fleece weights are closely associated with the greasy fleece weights cut by sheep in many flocks in Queensland, the time and expense involved in sampling and scouring may not be justified. You can select your ewes on greasy fleece weight alone. If you wish to do this, the easiest way to proceed is as follows:—

(1) At classing time cull the young ewes showing disqualifying faults in their conformation or covering.

(2) Shear the sheep and weigh the fleeces.

(3) Cull sufficient of the sheep cutting low greasy fleece weights to account for the remainder available for selection.

If you do this, you will need to be able to identify individual animals. This can be done quite easily by writing the respective numbers on their sides with a piece of raddle. Or it can be done with a pen made out of a metal tube, fitted with a piece of thick felt in one

end and a cork with a hole in it in the other end. The tube is filled with L.B.E. branding fluid and the number is written on the side of the sheep just as the shearer is cleaning the back of the neck and the head at the end of the long blow. The sheep can be rebranded on their backs with the numerals from the horse and cattle brand. This can be done when the sheep are either in, or as they are let go from the counting out pen. Some care is necessary to avoid overcrowding in the counting out pen, otherwise the numbers may smudge.

The flock owner who closes his flock to the introduction of new blood may be in a far stronger position to effect more rapid improvement in his sheep. Whether he is, depends on the quality of his flock, the rate of genetic improvement in the studs from which he had previously brought rams, etc. The question arises of incorporating fleece measurement in his flock improvement programme. There are two avenues of approach—through the ewes or through the rams. The rams will contribute by far the greater proportion of the improvement which will be achieved.

The classing of the ewes presents little difficulty provided the wool grower has a set of scales and some idea of how close is the association between greasy and clean scoured wool weights cut by his sheep. It may be necessary to have some samples scoured during the first few years to establish this fact; thereafter greasy fleece weights may provide all the information required.

The lowest cutters can be culled and the heaviest cutting ewes may be retained as a special ram breeding flock. The size of this flock will depend on three factors:—

(1) The number of rams required.

(2) The probable reproduction rates in the flock and their influence on the amount of selection which can be practised.

(3) The dangers of in-breeding.

However, the larger the better is the best principle on which to work!

Five hundred ewes will meet most requirements as a ram breeding flock for flocks of 2,000–3,000 breeding ewes. This breeding flock can be mated and lambed separately. As many replacements as possible for the ram breeding nucleus can be selected each year from the young ewes which cut a fleece equal to or above the average weight of the ram breeding flock, and which lamb from their first mating. This has the advantage of decreasing generation length and of getting as much as possible of the improvement you are making each year into your inner nucleus.

Rams bred in the ram breeding flock can be culled by visual appraisal for obvious faults. The fleeces of the remainder should be weighed and wool samples may be taken at their second shearing (assuming they are shorn as lambs). All samples can be scoured and the rams can be ranked in order of clean scoured wool weights. Some of them may have to be discarded if their wool is not of the trade type desired.

Alternatively, if it is thought necessary, staple length, fibre fineness and evenness can be measured and account taken of these measurements in the final selection.

You can pick the best 12 or 13 rams from each year's drop to mate with the 500 ewes in your ram breeding flock. Doing this means the fathers are replaced by their sons each year. However, the fathers can be used in the general flock. The reasons for doing this are obvious. If your selection is accurate, the sons should be better than their fathers. Therefore, it is advisable to avail yourself of this advantage. The other point in favour of doing this is that generation lengths will be shortened through the more rapid "turn-over" of rams.

Fleece Measurement in the Breeding of Stud Sheep.

Fleece measurement can be incorporated in programmes for improvement of stud sheep in different ways. The particular requirement of different studs influence the way in which fleece measurement may be used. However, consideration has still to be given to the progress likely to result from the additional labour involved in fleece measurement.

In setting up projects for closed studs, the principles suggested for closed flocks may be followed. It is more difficult to incorporate fleece measurement in "daughter" studs which continue to buy rams from "parent" studs. One of three situations could occur:—

(1) The "parent" stud may be progressing at its maximum rate. In these circumstances, the "daughter" studs will continue to progress, too, although they will be one sheep generation behind "parent" studs.

(2) The "parent" stud may not be progressing and the "daughter" stud may approximate it in quality. In these circumstances, the "daughter" stud would be better advised to close its gates to fresh introductions and to use fleece measurement as a basis of selection to breed its own top sires.

(3) The third possibility is that the "parent" stud may not be progressing and the "daughter" stud may not approximate the "parent" stud in quality. The "daughter" stud could then choose between two alternatives:—

(*a*) Continue buying rams from the "parent" studs, until the quality of the "daughter" stud approaches that of the "parent." The "daughter" stud can then be closed and breed its own rams.

(*b*) Buy rams from another stud which is also a "daughter" stud of the same "parent." Care should be taken to select the "daughter" stud which has been closed recently and whose future progress through the use or fleece measurement is assured.

What Does Fleece Measurement Offer the Queensland Sheep Industry?

We select sheep with the intention of improving our flocks. We hope to make them more even and more highly productive. By choosing parents we hope to breed still better sheep. Fleece measurement is a way of ensuring accurate selection. Flock owners can hardly afford to lose a bale of wool or so each year for the lifetime of every flock of 1,000 sheep they class by visual appraisal! Stud masters need not accept slower rates of genetic improvement in their flocks.

The cut per head of sheep in Queensland has increased by about ¾ lb. of greasy wool during the last 30 years. This has come from better breeding and better land use. Of this increase, the stud sheep industry may have contributed ⅜ lb. of greasy wool per head! This represents an improvement of one-fifth of an ounce of greasy wool per head per year from better breeding. Had fleece measurement been used in the selection of sheep in Queensland during this period, it is likely the overall increase in the cut per head would have been about 1½ lb., 1⅛ lb. resulting from the influence of the studs and ⅜ lb. from better land use.

Since 1945 the Queensland clip has earned, on an average, £44,000,000 per annum. That extra ¾ lb. of wool per head which could have resulted from better methods of selection would have contributed another £4,000,000 a year to Queensland.

Up to the present, fleece measurement has been used in 38 flocks in Queensland. Twelve of these, including studs and flocks which are closed to outside blood, have accepted fleece measurement as a basic part of their selection programmes.

[CONCLUDED.]

TOBACCO SEED STOCKS FOR 1954-55 SEASON.

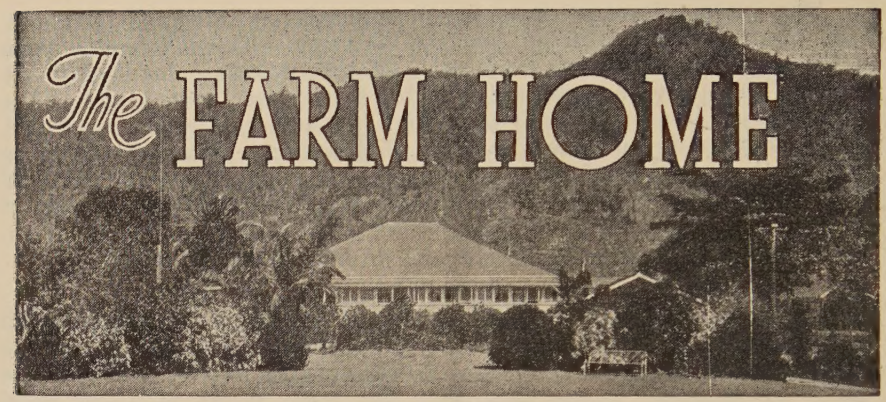
As in past years, Queensland tobacco growers have a wide range of good tobacco varieties available to them for the coming season.

The Department of Agriculture and Stock, which is the sole authorised seller of tobacco seed in Queensland, announces that ample stocks of the following varieties of tobacco are available:—Gold Dollar, Hicks, Virginia Gold, Mammoth Gold, Virginia Brightleaf, Kelly and 400. Limited stocks of 402 and Cash are also on hand.

All of these varieties have proved their ability to produce high yields of good-quality leaf under Queensland conditions. All have been grown with success in North Queensland, and the majority have also shown themselves well-suited for the central and south-western districts.

For many years past Gold Dollar was in greatest demand, but last season, for the first time, Hicks slightly exceeded it in general popularity. Third on the list last season was the new introduction, Virginia Gold, which has only been in commercial production for two seasons. This variety has achieved rapid popularity because of its good yields of light, lemon-coloured leaf. However, Virginia Gold must be handled carefully as there is a tendency for a large proportion of the leaf to carry a "cherry-red" colour if conditions are not quite right.

Seed production of the variety 401 is being discontinued because of the poor demand for it. The allied varieties 400 and 402 will, however, be retained. At the moment, ample supplies of 400 seed are available, but the stock of 402 will soon be exhausted. This variety will then remain out of stock until fresh supplies come to hand in 12 months' time. Growers who order seed of varieties which are indicated as being in short supply would be well-advised to list a substitute variety in case the first choice is not available.



Quick-Frozen Fruit and Vegetables.

By R. E. LEVERINGTON, Horticulture Branch.

Quick-freezing is a way of preserving fruit and vegetables for long periods. This method retains natural colour and fresh condition, but the length of time any product can be kept depends upon the freezing and storage temperatures.

The freezing compartment of an ordinary domestic refrigerator is quite suitable for keeping frozen fruits and vegetables in good condition for a couple of weeks provided the temperature setting is kept fairly low. If it is required to keep them for longer periods, special quick-freezing cabinets are necessary. The freezing and storage temperature should not be above 0°F. (that is, 32° below the freezing point of water).

Preparation.

It is essential that all quick-frozen fruits and vegetables be prepared and processed as soon as possible after harvesting, which is best done early in the morning. Fruits should be in a firm, ripe condition, while vegetables should be young and tender. Quick-freezing can retain the original quality of the food but it cannot improve it.

To improve flavour and prevent discolouration by the air, fruits are always packed in syrup or dry castor sugar and sealed in wax cups or plastic bags of moisture-proof material. There are three syrups used:—

(1) Light—containing 40% sugar prepared by dissolving 4 lb. of sugar in 5 pints of water.

(2) Medium—containing 50% sugar prepared by dissolving 5 lb. of sugar in 4 pints of water.

(3) Heavy—containing 60% sugar prepared by dissolving 6 lb. of sugar in 3½ pints of water.

For some light-coloured fruits it is necessary to add an anti-browning agent such as vitamin C, which is available from chemists in 250-milligram tablets.

Vegetables should be thoroughly washed and the edible portions prepared as for normal cooking. Fruits should be similarly washed and the edible portions cut into small pieces. A pre-cooking or blanching process in boiling water or steam is required to prevent subsequent deterioration in quality and appearance of vegetables. To prevent over-blanching, the product must be cooled immediately in running cold water.

After preparation, the product is packed in moisture and vapour-proof bags of about ½ lb. capacity; as much air as possible is excluded by clipping

the bag with a large bobby pin and then drawing the pin tightly up the bag. The bag can then be sealed with cellulose tape or by heating with an iron.

The sealed packages should now be flattened as much as possible and placed in the freezing compartment of a quick-freezing cabinet where the temperature should be below 0°F., preferably —20°F. Use the lowest possible setting of the temperature regulator. Quick-freeze only small portions at a time, otherwise the rate of freezing will be too slow. The packages should be frozen hard within 2–3 hours.

Storage.

Remove to the general frozen storage compartment and hold at a temperature of 10–15°F. if the food is to be eaten within 2 months, and at a temperature of 0°F. if it is required to be held for up to 12 months. Since the cabinet may contain other quick-frozen foods requiring lower storage temperatures, it will probably be found that a general

INSTRUCTIONS FOR INDIVIDUAL FRUIT.

Fruit.	Variety.	Type of Pack.	Other Instructions.
Apples ..	Any good desert variety	Light syrup ..	Add two 250-milligram vitamin C tablets to each pint of syrup
Apricots ..	Any variety ..	Heavy syrup ..	Add two 250-milligram vitamin C tablets to each pint of syrup
Bananas ..	Lady Finger does not brown as much as Cavendish	Heavy syrup ..	Add two 250-milligram vitamin C tablets to each pint of syrup
Gooseberries	Cape Gooseberry ..	Medium syrup ..	..
Mangoes ..	Preferably stringless, such as Kensington	Medium syrup or mix with castor sugar (3 parts fruit to 1 part of sugar)	..
Papaws ..	Any firm, rich-flavoured variety	Light or medium syrup or mix with castor sugar (4 parts fruit to 1 part sugar)	..
Passion Fruit	Golden or purple ..	Mix with castor sugar (3 parts of fruit to 1 part of sugar)	..
Peaches ..	Any good desert variety	Heavy syrup ..	Add two 250-milligram vitamin C tablets to each pint of syrup
Pears ..	..	Light syrup ..	ditto
Pineapples ..	Smooth or rough ..	Light syrup or mix with castor sugar (3 parts of fruit to 1 part of sugar)	..
Plums ..	..	Heavy syrup ..	..
Rockmelons	Fine-textured and rich - flavoured varieties	Heavy syrup ..	..
Strawberries	Rich-flavoured, firm varieties	Heavy syrup or mix with castor sugar (3 parts of fruit to 1 part of sugar)	..
Fruit Salad..	Whatever fruits desired, preferably with high proportion of pineapple	Medium syrup or mix with castor sugar (3 parts of fruit to 1 part of sugar)	..

storage temperature of 0°F. or lower is most satisfactory.

It is desirable that the utmost care be taken to keep all utensils, materials and storage cabinets as clean as possible in order to prevent the development of bacteria, which can cause "off" flavours or decomposition of the product.

Frozen vegetables should be cooked as soon as possible after removal from the frozen storage cabinet, as bacterial decomposition will occur as soon as the vegetable thaws. For a similar reason, quick-frozen fruit must be eaten as soon as it has thawed. Frozen vegetables, having been partly cooked. will cook in about half the time required for fresh vegetables and should be placed directly into boiling water, counting the cooking time from when the water starts to boil again.

INSTRUCTIONS FOR INDIVIDUAL VEGETABLES.

Vegetable.	Other Instructions.	Blanching Time in Boiling Water.
		Minutes.
Asparagus ..	..	3–4
Beans	String and slice before blanching	3–4
Beetroot	Cook normally, then slice or cube before freezing ..	..
Broccoli	..	3½–4½
Brussel Sprouts ..	..	4–5
Cabbage	..	4
Carrots	Slice or cube before blanching	3
Cauliflower ..	Cut into 1-inch pieces before blanching	3½–4½
Parsnips	Slice or cube before blanching	4
Peas	..	1–1½
Potatoes	Slice or cube before blanching	4–5
Spinach	..	1½–2½
Tomato Puree ..	Heat puree to 200–212° F. for 10 minutes, cool and then freeze	..
Turnips	Slice or cube before blanching	3½

Since larger pieces require slightly longer blanching, a variation in the blanching times of some vegetables is given. At the end of the blanching period, all vegetables must be chilled in water and allowed to drain for several minutes before packing. If it is desired to steam blanch, the time required will be 1–2 minutes longer than for boiling water blanching.

COUNTRY BREAKFAST SESSIONS.

The Rural Broadcasts Section of the A.B.C. is now providing regular breakfast sessions of interest to rural people from 4QY, 4AT and 4QS, Monday to Friday from 7 to 7.15.

Harry Greaves, stationed at Cairns, handles the northern programme, and Trevor Stockley conducts the southern programme from Toowoomba.